NARRATIVE END ITEM REPORT

SATURN S-IVB-208

DOUGLAS MISSILE & SPACE SYSTEMS DIVISION

JUNE 1968

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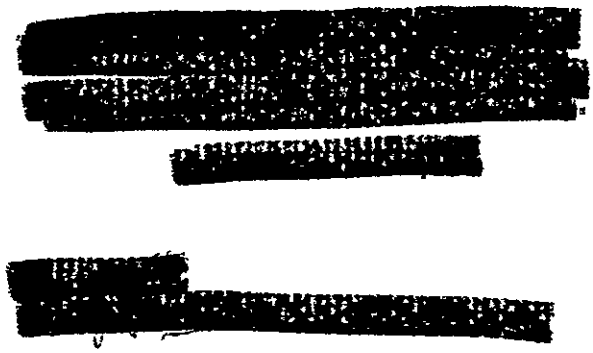

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DOUGLAS REPORT DAC-56499

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ABSTRACT

The Narrative End Item Report contained herein is a narrative summary of the Douglas manufacturing and test records relative to the Saturn S-IVB-AS208 Flight Stage (Douglas P/N 1A74633-513, S/N 2008).

Narrations are included on those conditions related to permanent nonconformances which were generated during the manufacturing cycle and existed at the time of acceptance testing. The report sets forth data pertinent to total time or cycle accumulation on time or cycle significant items. Data relative to variations in flight critical components is included. There is no provision to update or revise the NEIR after initial release.

Descriptors

NEIR
Documentation
Configuration
Significant Items
Stage Checkout
Manufacturing and Test

PREFACE

This Narrative End Item Report is prepared by the Reliability Assurance Operations Department of McDonnell Douglas Corporation for the National Aeronautics and Space Administration under contract NAS 7-101. This report is presented in response to requirements of NPC 200-2, paragraph 14.2.4, and is issued in accordance with Douglas Report SM-41410, Data Submittal Document, Saturn S-IVB System, which details contract data required from the McDonnell Douglas Corporation. The report summarizes the period from initial stage acceptance testing at the Douglas Space Systems Center, Huntington Beach, California, through final acceptance testing at the Douglas Sacramento Test Center (STC), Sacramento, California, and turnover to NASA/MSFC for delivery to NASA/FTC.

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1.0 INTRODUCTION

1.1 Scope

The NEIR compiles quality evidence and assessments of a particular end item for use in evaluating program objectives and end item usage. This report narrates upon the Saturn S-IVB-208 and discusses the following:

a. Final configuration.
b. Replacements made during test and final checkout (including serial number and change letter of articles removed or substituted).
c. Nature of problems and malfunctions encountered.
d. Corrective action taken or pending.
e. Extent of retests or tests not completed.
f. Total operating hours or cycles for each time or cycle significant system or subsystem.

1.2 Format

This document is organized into sections, with each section fulfilling a specific purpose. The title of each section, and a brief outline of its purpose follow.

SECTION:

1. INTRODUCTION. This section discusses the scope of the NEIR, the Stage Design Concept, Documentation, and Turnover Data.
2. SYSTEM TEST SUMMARIES. A brief summary of principal test areas is presented to give management personnel a concise view of successful test achievement, and remaining areas of concern.
3. STAGE CONFIGURATION. Conformance to Engineering design.
4. NARRATIVES. A presentation of checkout operations, presented with the checkouts at Sacramento Test Center (STC), followed by Space System Center (SSC) checkouts. Failure and Rejection Reports (FARR's) are referenced, as applicable for each paragraph.
5. POSTRETENTION. A presentation of stage configuration, additional stage testing prior to shipment (if any), final inspection, weight and balance, preshipment purge, retest requirements, post-checkout FARR's, and flight critical items installed at shipment.

1.2 (Continued)

APPENDICES:

1. CHARTS. Weld defect charts, which show weld discrepancies included in Table II Failure and Rejection Reports.
2. TABLES.
   a. TABLE I. A compilation of FARR's recorded during systems installation and checkout.
   b. TABLE II. A compilation of FARR's against structural assemblies.
3. GLOSSARY. A list of terms, abbreviations, and phrases used in the NEIR text, with a brief definition of each.

1.3 Stage Functional Description

A detailed systems analysis is beyond the scope of this report. The "S-IVB-208 Stage End Item Test Plan", 1B66532, contains a description of each operational system, and includes a listing of test procedures, with the objective and prerequisite of each test. Stage 208 is primarily a booster stage, consisting of propellant tanks, feed lines, electrical and pneumatic power for operation of stage systems, and such systems as are required for checkout purposes, fuel loading and unloading control, in-flight control and pressurization, and data measurement during these operations.

1.4 Documentation

Manufacturing and test records for this stage include Fabrication Orders (FO's), Assembly Outlines (AO's), Failure and Rejection Reports (FARR's), Serial Engineering Orders (SEO's), Radiographic Inspection Records, Hydrostatic test data, Vehicle Checkout Laboratory (VCL) test data, STC test data, and vendor data. FO's and AO's record in sequence all manufacturing processes, procedures, and Quality Control inspection activities. Any discrepancy from a drawing requirement is recorded on a FARR by Inspection and Test personnel. The FARR is also used to record the Material Review Board (MRB) disposition applicable to the discrepancy.

1.4 (Continued)

SEO's may be written to define the rework required by a FARR; to change the effectivity of a drawing; or to change other drawing requirements. Radiographic Inspection Records and X-ray photographs of all weld seams are maintained on file by the contractor. All original data is retained in the contractor's Reliability Assurance Department Central Data files. Vendor technical data is received on functional purchased parts and also retained in Central Data files. The majority of documentation referenced within this report is included in the log book which accompanies the stage.

1.5 Turnover Data

1.5.1 Douglas Space Systems Center

Transfer of the Saturn DSV-4B-2-1 (S-IVB-208) Stage, for transport to Douglas STC, was made on 1 December 1966, at Douglas SSC, Huntington Beach. A letter, A3-131-12.30.8-L-2997, dated 1 December 1966, from the Douglas Contracts Manager to the NASA/MSFC Resident Management Office, I-CO-SD/DAC, covered the submittal of documentation for purposes of technical transfer of the stage to STC. A copy of that letter and accompanying documentation was included in the Stage Log Book. Stage shipment was accomplished by packing sheet SM48923-6, dated 1 December 1966.

1.5.2 Sacramento Test Center

The turnover of Stage 208 for retention at the Sacramento Test Center was accomplished on 22 March 1967. On 24 March 1967, the stage was placed in storage per Contract Change Order 1181. Section 5 of this report, covering stage activities during and following the stage storage period, includes the final stage turnover and shipment data.

2.0 SYSTEM TEST SUMMARIES

The following paragraphs present a narrative summary of the system checkouts of Stage 208. System checkouts conducted at the Sacramento Test Center (STC) and the Space Systems Center (SSC) are summarized in paragraphs 2.1 and 2.2 respectively. Detailed narrations of the stage checkouts at STC and SSC, and of stage manufacturing tests at SSC, are presented in Section 4.

2.1 Stage Checkout, STC

The stage acceptance test program, conducted at the Sacramento Test Center between December 1966 and March 1967, verified the ability of the stage systems to function during a full duration static acceptance firing at sea level conditions. The S-IVB-208 Acceptance Firing Test Plan, SM-47458, delineated the general philosophies of the STC Test Program, and Test Request 1045, S-IVB-208 Stage Acceptance Firing, depicted the test requirements and authorized the acceptance firing. Stage preparations included the prefiring checkouts, an integrated systems test, and a simulated static firing.

2.1.1 Prefiring Activity

The stage arrived at STC on 2 December 1966, and was installed in the Beta Complex test stand I. For documentary presentation, the prefire checkouts were categorized as follows:

a. Test preparation.
b. Propulsion system tests.
c. Electrical/electronic systems tests.
d. Structural inspection.
e. Common bulkhead vacuum system test.
f. Environmental control systems tests.
g. Hydraulic system tests.
h. Integrated systems test.
i. Countdown operations.

The test preparations procedures covered the installation of the test equipment required to conduct and monitor stage system checkouts.

The propulsion system tests included a manual stage and GSE controls check, an automatic system checkout, and the preliminary and final leak checks.

The electrical/electronic systems tests consisted of ten procedures grouped as follows:

2.1.1 (Continued)

a. Power distribution tests.
b. Umbilical interface compatibility test.
c. Digital data acquisition system test.
d. Signal conditioning setup.
e. Propellant utilization tests.
f. Level sensor and control unit calibration.
g. Cryogenic temperature sensor verification.

The structural inspection checkout provided the required check points to verify the structural integrity of the stage.

The common bulkhead vacuum system checkout verified the integrity of the common bulkhead and the adjoining LOX and LH_2 tanks.

The environmental control systems tests checked out the temperature conditioning in the forward skirt, aft skirt, and interstage areas, and provided purging of these locations.

The hydraulic system setup and operation procedure, and automatic checkout procedure, verified the integrity, cleanliness, and operation of the system.

The integrated systems checkout verified that the stage and all associated ground support equipment were ready for propellant loading and static firing.

The countdown procedure controlled all tasks required for propellant loading, static acceptance firing, residual propellant off-loading, and stage securing.

2.1.2 Acceptance Firing

Countdown number 614076 was initiated on 11 January 1967, proceeded without incident through engine start on 12 January 1967, and achieved 427 seconds of mainstage operation. Mainstage firing was terminated by a programmed computer controlled cutoff, and stage securing operations proceeded normally.

2.1.3 Postfiring Activity

The postfiring systems checkouts, designed to verify that static acceptance firing had not adversely affected system performance, were initiated in the Beta I test stand and completed in the vehicle checkout laboratory (VCL).

2.1.3 (Continued)

For presentation, these checkouts are grouped as follows:

a. Propulsion system tests (test stand and VCL).
b. Electrical/electronic systems tests (test stand and VCL).
c. Hydraulic system tests (test stand and VCL).
d. Environmental control systems tests (test stand and VCL).
e. All systems test (VCL).

The propulsion system tests included test equipment removal, a manual controls check, system leak checks, and checks of the auxiliary propulsion system.

The electrical/electronic systems tests included checks of the stage power setup and turnoff; the power distribution system; the APS interface compatibility; the digital data acquisition, range safety, and propellant utilization systems; and the exploding bridgewire system.

The hydraulic system tests covered the postfiring operation and securing of the system.

The environmental control systems tests controlled the operation and checkout of the forward skirt thermoconditioning system and the aft skirt and interstage thermoconditioning and purge system.

The all systems test accomplished the final verification that the various stage systems would function collectively in a simulated flight situation.

2.2 Stage Checkout, SSC

The stage was placed in SSC VCL checkout tower 5 on 10 August 1966, and prepared for system tests. Checkout operations started on 18 August 1966 and terminated on 12 October 1966, after 39 days of activity. Detailed narration on all tests will be found in paragraph 4.2, with the following six major areas of testing covered:

a. Umbilical mechanical mating.
b. Environmental control systems.
c. Electrical/electronic systems.
d. Propulsion system.
e. Hydraulic system.
f. All systems test.

As certain portions of the testing program were performed simultaneously, the grouping is arbitrary in order to form a coherent sequence.

2.2 (Continued)

The umbilical mating tests, consisting of two procedures, verified the umbilical fit and function. No malfunctions were encountered.

The environmental control system tests of the forward skirt thermoconditioning system, consisting of three procedures, were satisfactorily completed. The check of the aft skirt and interstage thermoconditioning and purge system was also accomplished without significant problems.

The electrical/electronic systems tests consisted of eighteen procedures, divided into the following eleven areas:

a. Power distribution tests.
b. Continuity compatibility checks.
c. Propellant utilization tests.
d. Level sensor and control unit calibration.
e. Exploding bridgewire test.
f. Range safety tests.
g. Cryogenic temperature sensor verification.
h. Signal conditioning setup.
i. Digital data acquisition tests.
j. Telemetry and range safety antenna system test.
k. APS simulator test.

Revisions were made to the procedures as required to implement corrections and changes, and to allow testing with existing equipment shortages. Difficulties and problems were suitably resolved, including six items that were covered by FARR's.

The propulsion system tests consisted of the following categories:

a. Propulsion system control console/stage compatibility test.
b. LH_2 tank pressurization system leak check.
c. Pneumatic control system leak check.
d. Cold helium system leak check.
e. Propellant tanks leak check.
f. J-2 engine leak check.
g. Engine alignment.
h. Propulsion system automatic test.

All of the propulsion system tests were completed satisfactorily, with revisions as required. Leakage and other problems were suitably resolved, including two FARR items.

2.2 (Continued)

The hydraulic system tests, consisting of two procedures, were satisfactorily completed after some procedure and program changes. No FARR's were generated.

The all systems automatic test, performed with umbilicals in and with umbilicals out, was completed satisfactorily, with forty-eight procedural revisions. No failures were reported.

3.0 STAGE CONFIGURATION

Paragraph 3.1 discusses the means used to verify the stage configuration, while paragraph 3.2 presents those scope changes and engineering change proposals affecting the stage. Components and assemblies which are variations to the stage design are presented in Section 5.

3.1 Design Intent Verification

The configuration of this stage is defined in the Engineering Configuration List (ECL) for Space Vehicle, Model DSV-4B-2-1, Manufacturing Serial Number 2008, MSFC identification number S-IVB-SA208, revision A, dated 21 November 1966. This ECL document includes a listing of all parts, nonhardware drawings, and manufacturing and process specifications required for manufacture and testing of the stage, as defined by Engineering production drawings and EO releases. The ECL has been transmitted to NASA under separate cover.

Verification of design intent was accomplished by comparing the ECL, the Planning Configuration List (PCL), and the Reliability Assurance Department As-Built Configuration List (ABCL). Any noted discrepancies were resolved by the contractor, and a listing of the resultant action is filed at the contractor's facility.

3.2 Scope Changes and Engineering Change Proposals

SC/ECP's that affect Stage 208 are listed as follows: Paragraph 3.2.1 lists those SC/ECP's that were incorporated in the initial design. Paragraph 3.2.2 lists those SC/ECP's that were incorporated during manufacturing and VCL checkout. Those SC/ECP's that are not fully incorporated and verified at stage turnover to FTC are presented in Section 5.

3.2.1 SC/ECP's Incorporated in Initial Design

The following SC/ECP's were part of the original engineering release and were therefore incorporated in the initial design:

3.2.1 (Continued)

SC 1016B	SC 1185	SC 1354
SC 1027B	SC 1195A	SC 1363
SC 1075B	SC 1196	SC 1364
SC 1096	SC 1230	SC 1390
SC 1104A	SC 1232A	SC 1397
SC 1115	SC 1266	ECP X005
SC 1151	SC 1278A	ECP X043
SC 1152	SC 1282	ECP X095
SC 1167	SC 1295	
SC 1176	SC 1306	

3.2.2 SC/ECP's Incorporated During Manufacturing and VCL Checkout

The following SC/ECP's have been incorporated during manufacturing and recorded on the DD829-1 form in the Stage Log Book:

SC 1045B	SC 1274	ECP X176
SC 1124	SC 1280	ECP X178
SC 1153A	SC 1297A	ECP X180
SC 1187	SC 1326	ECP X190
SC 1189	ECP X021	ECP X239
SC 1193	ECP X056	ECP X255
SC 1203	ECP X099	ECP 0271
SC 1205	ECP X114	ECP 0278
SC 1207	ECP X124	ECP 0314
SC 1218	ECP X136	ECP 0354
SC 1241	ECP X137	

4.0 NARRATIVE - STAGE CHECKOUT

A narration of each test procedure required for stage systems checkout is presented in this paragraph. The major subparagraphs comprising the narrative are:

a. Stage Checkout - STC
b. Stage Checkout - SSC
c. Stage Manufacturing Tests

Each of these major subparagraphs is further subdivided to the degree required to present a complete historical record of stage checkout.

Permanent nonconformances and functional failures affecting the stage have been recorded on FARR's, which are referenced by serial numbers throughout this paragraph (e.g. FARR A229810). Those FARR's referenced in paragraph 4.1 are presented in numerical (serial number) order, in section 1 of table I; and those referred to in paragraphs 4.2 and 4.3 are similarly presented in sections 2 and 3 of table I, and section 1 of table II.

4.1 Stage Checkout - STC

Checkout of the stage at STC began in December 1966, and was successfully completed by March 1967. The handling and checkout precedures were performed to meet the objectives outlined in test request 1045, Stage Acceptance Firing. One countdown attempt was required to attain a successful acceptance firing of the stage. The prefiring and postfiring "as run" procedures reviewed under this paragraph were included as part of the Stage Log Book.

4.1.1 Test Preparation

The preparation of the stage for prefiring checkouts in the Beta I test stand was accomplished using two procedures. These were the propulsion system installation test preparation, and the electrical preparation document.

4.1.1.1. Propulsion Systems Installation Test Preparation (1B70451 A)

This manual checkout, initiated on 9 December 1966 and accepted on 4 January 1967, verified the configuration and performance of the propulsion system test installations required for static firing. The test sequence was:

a. Helium purges
b. Ground line connections to stage tanks.

4.1.1.1. (Continued)

c. Vehicle monitor panel and hardwire transducer connections.
d. Auxiliary pressurization system connections.
e. Prevalves ground control, ground connection to prevalves.
f. LH_2 prevalve shaft seal drain line.
g. Diffuser installation.
h. Hardwire transducer connections for tanks.
i. Ground support equipment pressure switch checks.

Eleven revisions were made to the procedure. One specified reinstallation of the non-propulsive vents; one provided for obtaining moisture samples; four revisions made required plumbing changes; one authorized a hookup to monitor the LOX tank pressure; one added connections erroneously left out of the procedure; two revisions deleted steps that were no longer necessary; and one updated the procedure to the latest EO change.

4.1.1.2. Electrical Preparation Document (1B71089 A)

The purpose of this procedure was to accumulate all electrical prefiring test-oriented jobs into a single document.

The jobs were conducted between 7 December 1966 and 10 January 1967. Two revisions were written. One deleted steps not required for this stage checkout, and the other revision changed cable callouts to make them agree with drawing 1A83832. There were no discrepancies recorded.

4.1.2 Propulsion System Tests, Prefiring

The automatic and manual checkouts of the function and integrity of the stage propulsion system, in preparation for static acceptance firing, consisted of the following four procedures:

a. Stage and GSE manual controls check.
b. Propulsion system test (automatic functional checkout).
c. Propulsion system leak check.
d. Final propulsion system leak check.

4.1.2.1. Stage and GSE Manual Controls Check. (1B70177 C)

The manual mode of the components in the stage and GSE propulsion system controls was verified by this procedure. Between 12 and 14 December 1966, the pneumatic regulators in consoles A and B, and the stage, as well as the separate solenoid and pneumatic valves in consoles A and B, the LH_2 and LOX control skids, and in the stage, were manually functioned.

4.1.2.1 (Continued)

Two revisions were incorporated in the test. One deleted steps not required for this stage, and the second provided for and authorized the checkout of the trickle purge system.

4.1.2.2 Propulsion System Test (1B62762 D)

Performed on 21 December 1966 and accepted for filing on 7 January 1967, this automatic test verified the integrated electrical/mechanical function of the stage propulsion system preparatory to static acceptance firing. The automatically programmed sequence of events included:

a. Pressure switches test.
b. Pneumatic control system test.
c. LH_2 and LOX tank pressurization system test.
d. J-2 engine system test.

Twenty-eight revisions were written to this procedure. Eleven corrected program errors; six changed program parameters; eight accepted minor discrepancies or test condition changes; two deleted steps not required; and one corrected typing of the malfunctions.

4.1.2.3 Propulsion System Leak Check (1B70176 C)

This manual procedure was conducted to verify that the stage propulsion system was free of detrimental leakage conditions prior to static firing. Conducted between 8 December 1966 and 4 January 1967, the test included the following steps:

a. Equipment setup.
b. Relief valve functional checks.
c. Pressure switch checks.
d. Stage proof checks and pneumatic system leak and functional tests.
e. Turbopump torque checks.
f. Engine checks.
g. Fuel and oxidizer tank checks.

Twenty-two leakage conditions were described on the leak check log. Nineteen were corrected by replacing seals and/or retorquing loose connections; one was found to be a duplicate entry in the leak check log; and two were acceptable to Engineering for use.

4.1.2.3. (Continued)

Forty-three revisions were made to this checkout as follows:

a. Seven revisions modified the system in support of the automatic propulsion tests.
b. Four deleted steps which were no longer required.
c. Nine revisions revised or deleted other revisions.
d. Two revisions removed orifices in support of other portions of the test.
e. Two revisions provided a method for pressurizing or isolating the thrust chamber as required for certain parts of the tests.
f. One revision provided for maintaining a constant ullage pressure.
g. One revision authorized leak check of the fuel pressure module check valve reverse flow and redundant check valve reverse flow.
h. One revision provided the hookup required to check out the engine purge system.
i. Another revision authorized the use of a trickle purge required while the LH_2 chilldown pump was being replaced.
j. A revision provided a procedure for finding the pneumatic decay rate of the system.
k. One revision provided a procedure for making engine pneumatic control leak checks.
l. One revision increased the leakage tolerance for the LH_2 vent and relief valve to allow its use during static firing.
m. One revision determined the supply pressure required to achieve 450 psig at the LOX dome purge diffuser.
n. Another revision removed a test plate from the pipe assembly purge valve inlet and torqued the bolts, thus completing the engine pneumatic package.
o. One revision provided a more positive way to check the pipe assembly purge valve seat.
p. One revision provided the start bottle decay test.
q. One revision made the changes required for SIM static firing.
r. A revision authorized the steps needed to maintain the vehicle purge system.
s. Two revisions provided for console B integrity tests.
t. One revision specified checkouts of hardwire transducers not normally checked when the system was pressurized.
u. One revision provided for a 0-60 gauge to be used instead of a 0-100 gauge since the latter was not available.
v. One revision allowed greater GN_2 flow in the system.
w. One revision changed the misleading nomenclature on a test plate.

4.1.2.4 Final Propulsion System Leak Check (1B70175 C)

This manual leak check procedure, conducted and accepted by Engineering between 7 and 9 January 1967, verified the function of the stage propulsion system just prior to static acceptance firing. The tests conducted included:

4.1.2.4 (Continued)

a. Console valve integrity check.
b. Stage pneumatic system leak check (helium).
c. Cold helium system leak check (helium).
d. LOX and LH_2 tankage leak checks (helium).
e. Engine thrust chamber leak check.
f. Engine start bottle leak check.
g. Engine pneumatic leak and functional check.
h. Removal of crossovers.
i. System purges.

Three leakage conditions were noted on the leak check log. Two were corrected by replacing seals, and one was resolved by retorquing a fitting.

Twenty revisions were recorded in the log sheet. Nine deleted steps not required for this checkout, six revisions provided methods or procedures required for the testing of the engine control and engine start bottles; one increased the cold helium lockup time; one revision connected a test gauge to monitor thrust chamber pressure; one provided for the removal of the test plates; one revision decreased the pressure of the first stage GN_2; and one changed the designation of the cold helium solenoid connector L3903W2 from P49 to P23. There were no malfunctions recorded to this procedure.

4.1.3 Electrical/Electronic Systems Tests, Prefiring

The narrative presentation on the checkout of the stage electrical/electronic systems is subdivided for presentation as follows:

a. Power distribution tests
b. Umbilical interface compatibility check
c. Digital data acquisition system checkout
d. Signal conditioning setup
e. Propellant utilization system tests
f. Level sensor and control unit calibration
g. Cryogenic temperature sensor verification

4.1.3.1. Power Distribution System Tests, Prefiring

Three test procedures were performed to ensure the proper function of the power distribution system components, as well as the ability of the ACS to remotely activate, control, and deactivate stage power. These included the stage power setup, power distribution system, and stage power turnoff.

4.1.3.1.1 Stage Power Setup (1B59496 C)

Performed on 10 December 1966, and certified for filing on 13 December 1966, this automatic checkout contained the steps which verified the operational capability of the ACS to control and activate the stage electrical power distribution system prior to automatic systems checkout. These procedures also ensured that the stage forward and aft power distribution systems were not subjected to excessive static loads during initial setup sequences.

One revision was written to delete unnecessary steps. There were no functional failures.

4.1.3.1.2 Power Distribution System (1B59498 C)

Due to faulty shorting out modules, this automatic test had to be rerun in order to reverify the power distribution system. The first run was conducted on 16 December, and the second on 27 December 1966. The various tests performed established that static loads were not excessive. At the same time, the operational capability of the automatic checkout system (ACS) to control power switching to and within the stage was verified.

Eleven revisions were written to this automatic test of which five were made during run one, and six were written during the second run. Revisions to the first run include: Two revisions deleting steps not required; one rerunning the first portion of the procedure due to a malfunction in the PCM RF assembly current calculation routine; one verifying the new EDS system wiring; and one manually measuring chilldown inverter voltages. The six revisions to the second run included one authorizing the rerunning of the test; two deleting and modifying steps as required; one verifying the operation of the No. 4 LOX and LH_2 level sensors; one deleting erroneous results caused by improper setups; and one verifying the new EDS wiring.

A second issue of this procedure was made necessary due to the large amount of rework performed on components tested. Issue two was conducted on 9 January, and certified for filing on 11 January 1967.

Five revisions were made to this issue, as follows:

4.1.3.1.2 (Continued)

a. One provided a process for verifying the new EDS wiring.
b. Two revisions deleted statements no longer required.
c. One provided a method for verifying the operation of the LOX and LH_2 No. 4 level sensors.
d. One revision explained that chilldown inverter data collected on run, issue one was acceptable.

4.1.3.1.3 Stage Power Turnoff (1B59497 C)

This automatic checkout contained the automatic and manual procedures used to shut down the stage power distribution system after the completion of various stage checkout procedures. Also verified was the capability of the GSE to control power switching to and within the stage.

The tests were successfully conducted on 10 December and certified for filing on 15 December 1966. There were no revisions or other discrepancies recorded against these procedures.

4.1.3.2 Umbilical Interface Compatibility Test (1B64306 C)

Provided in this document was the procedure to check the integrity of the stage umbilical wiring, and to assure that proper loads were present on all power busses, and that the control circuits for propulsion valves and safety items on the stage were within prescribed tolerances.

Five revisions were written to this procedure. Two accepted out-of-tolerance readings; one deleted steps not required; one changed tolerance values; and one called out remeasuring a parameter after the installation of module 403A73A1.

4.1.3.3 Digital Data Acquisition System (1B59500 C)

The automatic digital data acquisition test, performed on 27 December 1966 and accepted on 3 January 1967, provided the operational status verification of all data channels on the stage. Channels equipped with signal insertion capability were compared to tolerance limits with a high and/or low mode calibration command programmed through the remote automatic checkout system (RACS). Channels without RACS capability were tested by comparing the end item outputs under ambient conditions to their tolerance limits. This test

4.1.3.3 (Continued)

included the proper operation of all signal conditioning units, associated amplifiers, command calibration channel decoders, multiplexers, digital data acquisition assembly and central command calibration decoder assembly.

Fifteen revisions were written. Three corrected program errors; three rejected and made provisions for replacement and test of faulty equipment, (reference FARR's A219063, A219071, A229702, A229706); and nine revisions retested and found acceptable equipment that had malfunctioned due to improper test conditions, improper hookups, unusual ambient conditions (ambient temperature was 36°F), or test equipment malfunction.

The second issue of this automatic test was conducted on 9 January 1967 and accepted for filing on 10 January 1967. This procedure verified the operational status of all data channels on the stage.

Fourteen revisions were made to this test as follows: Three corrected program errors; nine explained apparent malfunctions and showed that the parameters were actually within tolerance; and two revisions provided for the rejection and replacement of a transducer and a DC amplifier which will be replaced and reverified during postfire runs (Reference FARR's A229706 and A229707).

4.1.3.4 Signal Conditioning Setup (1B63149 B)

This manual checkout calibrated the signal conditioning equipment when it was found to be out of tolerance during automatic checks, or when a replaced component was found to be out of tolerance. In addition, it was used to verify the calibration of the 5 and 20 volt excitation modules.

The checkout was conducted successfully between 22 December 1966 and 5 January 1967. Two revisions were recorded. One changed the tolerance on measurement M25-404, and the other revision deleted sections not required at this time.

4.1.3.5 Propellant Utilization System Tests

The prefiring checkout of the propellant utilization system consisted of a manual calibration procedure and an automatic checkout.

4.1.3.5.1 Propellant Utilization System Manual Calibration (1B63373 B)

This checkout was initiated on 15 December 1966, and was accepted by Engineering on 10 January 1967. As verification of the manual calibration of the propellant utilization system, the sequence of tests included:

a. Verification of static inverter/converter output voltages.
b. LH_2 and LOX bridge checks.
    1. Empty and full calibration.
    2. Data acquisition - position.
    3. Slew checks - 1/3 and 2/3 slew.
    4. Linearity checks.
c. Ratiometer calibration.
d. Hardwire loading circuits.

One revision was written to explain that the helium purity in the stage tanks was maintained at a 99 per cent level by keeping the tanks under positive pressure at all times

4.1.3.5.2 Propellant Utilization System (1B59504 C)

This automatic checkout was conducted on 19 December 1966, and was certified for filing on 10 January 1967, after ensuring that the propellant utilization system was able to control the propellant flow mixture ratio in such manner as to achieve simultaneous propellant depletion. Four revisions were made to the checkout as follows: One corrected program errors; one entered the PU constants via paper tape; one revision added a slew of the PU valve in the opposite direction from that obtained with the LOX 1/3 checkout commands (Reference NASA letter I-I/1B-SIVBS-VCL-L216); and the last revision provided for the obtaining of the postfire reverse slew data since the prefire data was inadvertently lost.

4.1.3.6 Level Sensor and Control Unit Calibration (1B63148 B)

The purpose of this manual checkout was to adjust the operating point of the point level sensor control units to an operating level well within the limits of the capacitance change created in these units by a simulated wet condition RACS command.

The test was conducted between 14 and 30 December 1966.

Four revisions were written as follows:

4.1.3.6 (Continued)

a. Two calibrated the LOX and Fuel level sensor control units.
b. The third revision repeated steps which were not completed until a missing jumper wire was replaced.
c. A revision deleted steps not required at this time.

There were no discrepancies recorded against this checkout.

4.1.3.7 Cryogenic Temperature Sensor Verification (1B63146 A)

The manual checkout established in this procedure, conducted on 9 December 1966, verified the operational capability of each temperature sensor for which the normal operating range did not include ambient temperature.

One revision was made to allow the measuring of C040, temperature, oxidizer tank position 1.

There were no malfunctions recorded.

4.1.4 Prefire Structural Inspection (1B40645 A)

Initiated on 5 December 1966 and accepted by Engineering on 9 January 1967, this structural inspection verified that transportation and handling had no detrimental effect on the stage structure and established the prefire condition of the stage for comparison with the postfire condition.

The prefire inspection included a visual receiving inspection of electrical, propulsion, and structural components per quality engineering charts 339, 328, 330, 340, 341, 342 and 344, and a radiographic inspection of the "V-section".

Two revisions were written deleting the requirements of the APS fit check and the visual inspection of the LH_2 and LOX tank interior and installations, because this was to be performed during postfire structural inspection.

4.1.5 Common Bulkhead Vacuum System (1B49286 F)

This manual checkout was started on 10 December 1966 and was successfully completed on 9 January 1967, verifying that the common bulkhead system was functionally capable of providing an evacuated thermal insulator between the fuel and oxidizer tanks prior to static firing. The checkout included

4.1.5 (Continued)

the following activities:

a. Test stand vacuum system setup and checkout.
b. Common bulkhead checks.
    1. Pumpdown, 96 hour.
    2. Decay check.
    3. Argon purge.
    4. Leak check - tanks pressurized.

Two revisions were written to this procedure. One provided for conducting a full 12 hour leak check which was not previously accomplished, and the second revision provided for the initiation of the bulkhead pumpdown after the 12 hour leak check.

4.1.6 Environmental Control System Tests, Prefiring

Two test procedures were conducted to ensure that the environmental control system components and linkages were both structurally sound and functional. They were:

a. Forward skirt thermoconditioning system checkout.
b. Forward and aft skirt purge systems.

4.1.6.1 Forward Skirt Thermoconditioning System Operation (1B41955 A)

Provided in this procedure was the equipment setup required to connect the thermoconditioning system servicer, P/N 1B78829-1, to the forward skirt thermoconditioning system. The procedure also contained a TCS leak test, remote operation test, water/methanol cleanliness test, water/methanol specific gravity test, TCS differential pressure test, and operational test.

Conducted between 7 and 29 December 1966, this checkout was accomplished without revisions.

4.1.6.2 Environmental Control System, Forward and Aft Skirt Purge (1B43749 A)

This manual checkout, conducted between 27 and 30 December 1966, verified the environmental control system installation, P/N 1A77551-1, on the test stand. The test included checkouts of the forward and aft skirt purge system. There were no revisions recorded against this checkout.

4.1.7 Hydraulic System

Two tests were used to verify the operation of the hydraulic system, one a manual, and the other an automatic procedure. They were as follows:

a. Hydraulic system setup and operation.
b. Hydraulic system automatic.

4.1.7.1 Setup and Operation, Hydraulic System (1B41005 A)

Initiated on 15 December 1966 and accepted on 9 January 1967, this checkout verified the initial operation setup, as well as the maintenance of system readiness preparatory to static acceptance firing. The operational checks included:

a. Verification that all hydraulic system components were securely installed.
b. Verification of the proper pump rotation and leak check of the entire system.
c. Actuator center check to ascertain the difference between the mechanical center and hydraulic center.
d. Engine deflection clearance check between the engine, stage and test stand structure, and components.
e. System refill instructions to replace fluid lost through thermal expansion or closed loop sampling.
f. Instrumentation support to provide hydraulic pressures, positions, and levels.
g. Shutdown operations, including a final air content check for system performance analysis.
h. Simulated static firing support through simulation of the engine driven pump flow capabilities.

Four revisions were incorporated in the log sheet. One specified removal and proper re-installation of the differential pressure transducers for the pitch and yaw actuators. Another provided that an integrity check be conducted after re-installation of the transducers. One performed certain items per 1B41004. One required performing certain paragraphs prior to securing the HPU.

4.1.7.2 Hydraulic System (1B59508 C)

This automatic checkout, successfully conducted on 16 December 1966, and certified for filing on 3 January 1967, consisted of the following tests:

a. Accumulator precharge test.
b. Reservoir oil volume switch test.
c. Reservoir oil pressure transducer test.
d. Inlet temperature test.
e. System pressure test.
f. Reservoir oil volume position transducer test.
g. Accumulator reservoir oil pressure test.

4.1.7.2 (Continued)

h. Polarity and linearity tests.
i. Frequency response tests.
j. Engine centering tests.

All of the foregoing tests were performed when the stage was in the vertical position. Five revisions were made to this checkout as follows:

a. Two revisions were made to correct program errors and Ground Instrumentation System problems.
b. Two revisions executed backups, one due to suspected engine gimbal interference and another due to a line printer malfunction.
c. One revision explained the reason for program halt 18-1-2.

There were no discrepancies recorded against this checkout.

4.1.8 Integrated Systems Test (1B59514 D)

This automatic test verified the functional readiness of the stage and facility to proceed with countdown operations prior to static firing. Included were the following checkouts:

a. Propellant utilization system checks.
b. Digital data acquisition checks.
c. Ambient helium pressure checks.
d. Checks of critical components such as fill and drain valve.
e. Engine gimbal checks.
f. Power distribution and voltage tests.

Two runs were performed. The first was conducted on 29 December 1966 and filed on 7 January 1967. The second run was conducted on 10 January, and was accepted and filed on 12 January 1967. The second run was made to verify selected control and instrumentation circuits which were invalidated following the simulated static firing procedure when approximately 60 potted bus connectors were replaced due to suspected malfunctions.

The first run included the following 23 revisions: Five corrected program errors; six explained and accepted out-of-tolerance values; two entered constants into the program; six explained malfunctions in the test setups not done and steps not up to date; one deleted an unnecessary step; one repeated J-2 engine sequence tests; one repeated segment 8 of the test; and one turned on the engine control package power and engine component test power. The second run had 28 revisions. Eight accepted values apparently out-of-tolerance; six corrected program errors; two corrected DDT errors; two allowed minor malfunctions which did not degrade stage performance; two revisions called for bypassing some steps in order to expedite testing; two revisions provided for completing

4.1.8 (Continued)

the bypassed segments; one provided for concluding the bypassed steps; two entered constants into the program parameters; one completed test setups not completed; one deleted the self RC check; one turned on the engine control package power and the engine component test power; and one explained a major malfunction (GH_2 line pressure), its correction, and retest.

4.1.9 Static Acceptance Firing Countdown Procedures

This paragraph covers the static acceptance firing simulated countdown exercise, and the static acceptance firing countdown procedures which were conducted to achieve an acceptable static firing. Also included are reviews of the critical tasks accomplished as part of the countdown procedure.

4.1.9.1 Countdown, Acceptance Firing Simulated Exercise (1B70270 NC)

The simulated countdown number 614075 was initiated on 5 January at 0800 hours and successfully completed on 6 January 1967 at 1440 hours. With the exception of propellant loading, acceptance firing, and residual propellant off-loading; the static firing countdown manual demonstrated the overall state of readiness of the stage, ground support, and facility equipment to proceed with formal countdown activities. Several minor GSE problems were encountered during the countdown; however, no holds were required.

4.1.9.2 Countdown, Acceptance Firing (1B70270 NC)

This acceptance firing test countdown, number 614076, was started on 11 January at 0750 hours and culminated in a full duration acceptance firing lasting approximately 427 seconds on 12 January 1967 at 1212 hours. The following major events were included:

a. Loading LOX and LH_2 automatically to the acceptance firing requirements.
b. Propellant tank vent valve relief cycle check.
c. Acquisition of boil off data.
d. Critical component cycle tests.
e. Normal engine start sequence.
f. Propellant utilization activation 6 seconds after the engine start command.

4.1.9.2 (Continued)

g. Engine side load restrainer links release 25 seconds after mainstage control.
h. Initiation of an automatically controlled engine gimbal program following restrainer link release.
i. Activation of the secure range safety command system with the required command signals sent (255 seconds after simulated lift off) via open loop transmission, and interruption of the system output circuits to prevent cutoff and prevalve closure.
j. Movement of the propellant utilization valve after 280 seconds of mainstage control, from the LOX rich stop (5.5 to 1) to the nominal position for the reference mixture ratio (4.7 to 1) for the remainder of the firing duration.
k. Conducting the control test of the model 188 APS simulators after engine start, during mainstage operation.
l. Automatic cutoff initiation at 1933 pounds of LOX or 759 pounds of LH_2 with the depletion level sensor armed at three per cent residual mass as backup. Although minor problems were encountered, the countdown was completed without the need for a hold.

Discrepancies were recorded on FARR's A219018 and A219019.

Run 1A, Task 14, Propulsion System Test (1B62762 D)

Conducted on 11 January and accepted on 12 January 1967, as task 14 of the countdown, this checkout verified the readiness of the system for static firing. Only section five, J-2 engine checkout, was conducted at this time.

Three revisions were made to the test. One corrected a program error, one explained the loss of talkback from the main LOX valve; and the third deleted steps not required at this time. There were no open discrepancies at the conclusion of this test.

Task 33, Integrated Systems Test (1B59514 D)

Performed on 11 January and accepted on 13 January 1967, this test was conducted as task 33 of the countdown manual, and verified the functional capability of the stage, GSE, and facility systems to proceed with propellant loading and subsequent acceptance firing.

Twenty-four revisions were made to this checkout as follows: Six revisions corrected program errors or set up parameter changes; seven made apparent discrepancies acceptable to Engineering; two entered program test constants;

4.1.9.2 (Continued)

two provided for retesting and finishing tests on aft bus 2; one revision corrected a DDT error; one reran the J-2 sequence since the sequence oscillograph jammed on the first run; one revision turned on the engine control package power and engine component test power; one deleted RC self checks; one explained why the engine control bottle was not pressurized in time; one revision explained an EBW malfunction and rejection; and one allowed for deletion of the pretest setup since countdown tasks run to this point ensured the proper setup.

Tasks 39 and 40, Countdown, Propellant Loading (1B59515 C)

Performed on 12 January and certified for filing on 18 January 1967, as tasks 39 and 40 of the countdown manual, this automatic propellant loading checkout verified the capability of the facility and GSE to safely transfer LOX, LH_2, and GHe to the stage prior to static acceptance firing. The test sequences included:

a. LH_2 tank pretest purge.
b. LOX loading.
c. LH_2 loading and cold and ambient helium bottles fill.
d. Special tests.
    1. LOX tank overfill sensor check.
    2. LH_2 tank overfill check.
    3. Flow check of all cold gas circuits.
e. LH_2 umbilical purge.
f. LOX umbilical purge.

Six revisions were written to this checkout. Three revisions corrected program errors; one correctly defined executive cells; one deleted cold helium checks; and the last rejected the chilldown valves because there was no talkback. (Reference FARR A219017).

Tasks 42 and 43 Countdown, Acceptance Firing (1B59516 C)

Conducted on 12 January 1967 as tasks 42 and 43 of the countdown manual, this checkout exceeded all Engineering standards of acceptance, verifying the capability of the stage to function in a hot firing environment generated by the J-2 engine under full thrust and full duration conditions. The firing lasted approximately 427 seconds. Seven revisions were recorded. Four corrected program errors; one added a time delay after turning off the

4.1.9.2 (Continued)

prelaunch checkout group; one explained a chilldown valve talkback malfunction; and one revision explained a discrepancy on the accumulator.

4.1.10 Propulsion System Tests, Postfiring

Following the successful static firing, three test procedures were accomplished to verify that the structure and function of the propulsion system had not been adversely affected by the firing. These tests were the test fittings removal procedure, a system leak check, and a propulsion system automatic checkout.

4.1.10.1 Propulsion System Test Fittings Removal Procedure (1B70455 A)

Performed and accepted by Engineering between 24 and 27 January 1967, this manual checkout procedure provided the requirements necessary for configuration and conformance verification subsequent to removal of the stage propulsion system test installations, and preparatory to final leak checks and removal from the test stand. The test installation components removed were replaced with caps, plugs, and/or desiccant covers, as well as applicable seals or gaskets.

Four revisions were written to this procedure, providing additional information and instructions for test component removals and stage securing.

There were no discrepancies on record.

4.1.10.2 Propulsion System Leak Check (1B70413 A)

Performed and completed between 13 and 30 January 1967, subsequent to the full duration static acceptance firing, this leak test verified that the stage propulsion system was acceptable to Engineering while in the test stand. The checks were completed in the VCL.

One entry was made in the leak check log concerning a leak in the engine bell extension near a drain screw.

Five revisions were entered in the log sheet as follows:

a. One authorized the flow check of the LH_2 chilldown shutoff valve and fairing purge system.

4.1.10.2 (Continued)

b. One provided a method for obtaining flow rates with flight configuration parameters.
c. One revision provided a method for observing transducer line purge effects on pressure at the transducer.
d. Another provided for rerunning the previous revision to compare and ascertain that approximately the same flows were obtained using a valve other than a flight configuration part in the system.
e. The last revision deleted sections not required.

4.1.10.3 Propulsion System Test (1B62762 C)

Section 2 of this checkout was performed on 17 January 1967, and sections 1, 3, 4 and 5 were performed on 18 January 1967. Acceptance by Engineering was made on 27 January 1967, verifying that the propulsion system was functional, subsequent to a full duration static acceptance firing. The test sections included:

a. Pressure switches test.
b. Pneumatic control system test.
c. LOX tank pressurization system test.
d. LH_2 tank pressurization system test.
e. J-2 engine system test.

Thirty-one revisions were written to this checkout. Ten corrected errors in the program; five accepted out-of-tolerance conditions as not detrimental to the system or the test; eight corrected TRD wait time errors; four corrected errors to the manual setups; three corrected GSE problems; and one added time data recording requirements for the LH_2 vent valve actuation boost close and total boost close times.

There were no abnormalities on record.

4.1.11 Electrical/Electronic System Tests - Postfiring

The postfiring Beta Complex test stand electrical/electronic tests performed on the stage prior to installation in the VCL tower were:

a. Stage power setup.
b. Stage power turnoff.
c. APS interface compatibility.
d. EBW system.
e. Electrical preparation.

The following tests were not performed in the test stand because they were not included in the Beta Test Area Control Document (TACD), or they were deleted by a TACD revision:

a. Power distribution.
b. DDAS manual calibration.
c. DDAS auto calibration.
d. DDAS system auto checkout.
e. Range safety receiver manual checkout.
f. Range safety receiver auto checkout.
g. Range safety system auto checkout.
h. PU system calibration.
i. PU system auto checkout.
j. Cryogenic temperature sensor verification.
k. Level sensor and control unit calibration.

4.1.11.1 Stage Power Setup (1B59496 C)

Conducted on 16 and 17 January 1967, this procedure verified the operational capability of the automatic checkout system (ACS) to control and activate stage electrical power distribution prior to automatic system checkouts. The test also ensured that the stage forward and aft power distribution systems were not subjected to excessive static loads during initial setup sequences. It also demonstrated stage system internal switching capabilities. There were no revisions or other discrepancies.

4.1.11.2 Stage Power Turnoff (1B59497 C)

Conducted on 16 January and accepted on 17 January 1967, this automatic checkout provided the automatic and manual procedures used to shut down stage power distribution after the completion of stage system checkouts.

This checkout was successfully completed without any revisions or discrepancies recorded.

4.1.11.3 APS Interface Compatibility Check (1B60142 C)

This manual checkout was started on 13 February 1967, and was accepted by Engineering on 28 February 1967. It provided the instructions for conducting continuity/compatibility tests after the installation of the APS simulators on the stand and prior to operational tests on the stage.

There were three revisions made to this procedure. The first deleted the section pertaining to active APS units. The second corrected a typographical error, and the third changed resistance reading tolerances to correspond to stage wiring changes.

No other discrepancies were recorded during the course of this procedure.

4.1.11.4 Exploding Bridgewire System (1B59503 B)

This checkout defined the manual setup and automatic tasks required to ensure the capability of the EBW system to initiate ullage rocket ignition and jettison when so commanded in flight by the IU. The checkout was conducted on 17 January and was certified for filing on 24 January 1967. The general test sequence was:

a. Preliminary EBW firing unit and pulse sensor test.
b. EBW firing unit pulse sensor self-test.
c. Ullage rocket ignition firing unit test.
d. Ullage rocket jettison firing unit test.

There were no revisions or discrepancies reported during the operation of this procedure.

4.1.11.5 Electrical Preparation Document (1B71090 A)

This manual electrical preparation checkout, conducted between 13 and 26 January 1967, described the removal and securing of test cables and equipment required to perform the prefire tests, simulated static firing, and static acceptance firing exercises.

Ten revisions were written of which five corrected procedural errors; four deleted steps not applicable to the stage or not required at this time; and one postponed the performance of a set of steps until the postfire checkouts were completed.

There were no discrepancies recorded against this procedure.

4.1.12 Hydraulic System Operation and Securing (1B41006 NC)

Initiated on 16 January and certified for filing on 26 January 1967, this manual checkout verified the postfiring operation, fluid sampling, and securing techniques for the hydraulic system installation. This test was performed prior to removal from the test stand. The tests included the following:

a. Ensuring that the hydraulic system installation was complete, and that all system instrumentation was in contact with internal fluid passage.
b. Hydraulic fluid cleaniness, per MSFC-PROC-166A, based on results of closed loop samples.
c. Hydraulic system preparation prior to stage removal from the test stand.

There was one revision made to this checkout, deleting steps for replacing sampled fluid, since the accumulator/reservoir assembly would be replaced.

There were no discrepancies recorded against this procedure.

4.1.13 Thermoconditioning System Setup, Operation and Securing (1B41884 B)

Conducted between 24 and 26 January 1967, this manual checkout verified that the forward skirt thermoconditioning system was prepared (the moisture content within specified limits) and secured for stage removal from the Beta Complex test stand and transfer to the VCL.

Eight revisions were made to the procedure as follows: Five deleted steps not required for this stage; and three made procedural corrections which reflected the proper configuration.

No discrepancies or functional failures were recorded during operation of this procedure.

4.1.14 Postfire Propulsion System Checks

The automatic and manual procedures that were conducted at the VCL, after removal of the stage from the Beta Complex test stand, were:

a. Manual controls checks.
b. Propulsion system leak and functional checks.
c. APS propulsion system checkout.
d. APS propulsion system tests.
e. Stage test preparation.

4.1.14.1 Manual Controls Check (1B70682 A)

This manual checkout, performed and accepted by Engineering between 6 and 9 February 1967, verified the operational capability of the manually controlled stage propulsion components, and the moisture level of the stage pneumatic control and pressurization sphere.

One revision was written which altered the helium supply pressure requirements for the Model 321 pneumatic console.

There were no functional failures on record.

4.1.14.2 Propulsion System Leak and Functional Checks (1B70018 A)

This checkout procedure defined the operations required to certify the integrity of the stage propulsion systems after static firing.

The test was initiated on 3 February 1967, and was accepted by Engineering on 6 March 1967. It consisted of supplying electrical and/or pneumatic signals and pressures to stage systems and/or components and checking for proper response and leakage. Stage systems exercised included:

a. Vacuum readings, low pressure ducts.
b. Stage pneumatic system leak and functional checks.
c. Turbopump torque checks.
d. Engine start bottle leak check.
e. Engine check valve reverse flow checks.
f. Engine GG and exhaust system leak check.
g. Engine pump purge leak and flow check.
h. Engine thrust chamber leak check.
i. Engine pneumatic leak and functional checks.
j. LH_2 tank pressurization system leak and functional checks.
k. LOX tank pressurization system leak and functional checks.
l. LOX tankage leak and flow checks.
m. LH_2 tankage leak and flow checks.
n. LH_2 and LOX vent system leak checks.

Four discrepancies were written during this checkout and recorded on IIS 302675 as follows:

a. Item No. 1 - Flow meter readings were taken but the conversion charts were illegible - subsequent replacement of the conversion charts corrected the problem.
b. Item No. 2 - A leak check plug was missing from the thrust chamber pressure port - a plug was installed and the leak check was accomplished.
c. Item No. 3 - Recapped an IIS from the stage mechanical records against a leak at the drain screw on the J-2 engine bell extension - the leak was corrected.
d. Item No. 4 - A leak of 390 scims at the LOX vent elbow, P/N 1B52598, should have been 55 scims maximum. The leak was not corrected but was recapped to FARR A241916.

4.1.14.2 (Continued)

Fourteen leakage conditions were recorded during this procedure as follows:

a. Four leaks were recapped to FARR's A241901 and A241916.
b. Four leaks were repaired by replacement of seals.
c. Three leaks were repaired by retightening connections to proper torque value.
d. Three leaks were repaired by rewelding.

Sixty-seven revisions were written to this checkout with two being voided.

The revisions incorporated were:

a. Twenty-nine revisions revised steps to be compatible with the test configuration, with five resulting from R/NAA requirements and four resulting from shortages.
b. Twenty-one revisions added steps that were omitted, including four that were R/NAA requirements.
c. Thirteen revisions deleted steps that were not compatible with the test configuration, including one that was a requirement of R/NAA and five that were the result of previously accomplished steps.
d. Two revisions required a rerun of previously accomplished steps to checkout a replaced assembly and a modification by R/NAA.

4.1.14.3 APS Propulsion System Checkout (1B70491 A)

This procedure was used to checkout the functional integrity of the auxiliary propulsion system, when mated to the stage. Checkout was performed on APS module P/N 1A83785-531, S/N 2008-1, installed in position 1 (Position Plane I) and on module P/N 1A83785-531, S/N 2008-2, installed in position 2 (Position Plane III). The purpose of this procedure was to verify that each APS would function satisfactorily per design requirements.

This test was initiated and accepted by Engineering on 9 March 1967, and included the following checks:

a. Low pressure function of APS valves and systems.
b. Bellows position indicators in both the extended and collapsed positions.
c. Manually pressurized the APS system to blanket pressures:
    1. Monitored for prescribed time to verify no pressure loss.
    2. Performed automatic scan to check ullage and sphere transducers.
    3. Performed functional test of engine quad valves.

Eleven revisions were written to this procedure. Five deleted steps no longer required, five revised sequence requirements, and one changed a tolerance call-out to be compatible with instrumentation accuracy.

There were no functional failures on record.

4.1.14.4 Auxiliary Propulsion System Test (1B66917 A)

Initiated on 9 March and accepted by Engineering on 13 March 1967, this automatic checkout procedure verified that the response signals from the APS system were favorable. The telemetry response was verified on the pressure transducers, helium high and low pressure systems, and the MAG amp output associated with the propellant quad valve current.

Two revisions were written to this checkout. One corrected an error in the program, and one corrected a pressure tolerance to agree with manual setup procedure 1B70491.

There were no discrepancies recorded.

4.1.14.5 Stage Test Preparation (1B70684 A)

This manual checkout, commenced on 30 January 1967, and accepted on 22 March 1967, verified the configuration of those stage propulsion systems test installations which are required for stage checkout at the VCL, Sacramento. The major test installations included:

a. Stage purge system securing.
b. APS umbilical pressurization securing.
c. LOX and LH_2 fill and drain umbilical connections.
d. LOX vent connection.
e. LH_2 ground and non-propulsive vent connections.
f. Pneumatic supply and vent umbilical connections.
g. Stage monitor panel connections.
h. Auxiliary pressurization systems connection.

Eleven revisions were written to this procedure for: Five revised callouts due to updated configuration, three clarified procedure requirements, two were temporary requirements, and one revised the procedure to accommodate a part shortage.

No FARR's were written during the operation of this procedure.

4.1.15 Electrical/Electronic Checks - VCL

The electrical/electronic tests performed in the VCL tower after stage installation verified the integrity of the stage systems after static firing. The following tests were accomplished:

a. Stage power setup.
b. Stage power turnoff.

4.1.15 (Continued)

c. Power distribution.
d. DDAS auto checkout.
e. Range safety receiver manual checkout.
f. Range safety receiver auto checkout.
g. PU system auto checkout

4.1.15.1 Stage Power Setup (1B59590 E)

Initiated and accepted by Engineering on 7 March 1967, this procedure verified the capability of the ACS to control and activate stage electrical power prior to the initiation of stage automatic checkout procedures.

Three revisions were written to correct program errors.

There were no discrepancies recorded.

4.1.15.2 Stage Power Turnoff (1B59591 D)

Initiated and accepted by Engineering on 7 March 1967, this procedure verified the capability of the GSE to shutdown the stage power distribution system after completion of various system checkout procedures.

No revisions or discrepancies were recorded.

4.1.15.3 Power Distribution System (1B59592 D)

Performed on 7 March 1967, and accepted by Engineering on 15 March 1967, this automatic checkout verified the capability of the forward and aft power distribution assemblies to supply electrical power, as required through power switching networks, to the various stage systems.

The forward power distribution system consisted of two 28 vdc power sources. The aft power distribution system consisted of one 28 vdc power source, and one 56 vdc power source. In addition to the main power sources, each power distributor contained a 28 vdc talkback bus to provide talkback indication voltage for the GSE. The specific tests verified by this checkout were:

a. Static loads on power buses were within specified tolerances.
b. Proper operation of all switching circuits for power distribution.

Six revisions were written to this procedure; four corrected errors in the program, and two provided specific instructions to perform the chilldown inverter frequency and voltage checks.

4.1.15.3 (Continued)

There were no discrepancies on record.

4.1.15.4 Digital Data Acquisition System (1B59594 E)

This automatic digital data acquisition system checkout, performed on 10 March and accepted by Engineering on 16 March 1967, provided the operational status verification of all stage data channels with the exception of those data channels tested and accepted during specific systems tests (i.e. Exploding Bridgewire, Range Safety, etc.)

There were thirteen revision to this procedure for the following:

a. Nine corrected program errors involving tolerances, OSTOL statements, and changed set and reset commands that were not applicable for this checkout.
b. Four altered the program to perform the PCM/FM test last.

4.1.15.5 Range Safety Receiver Manual Operations (1B59829 D)

This manual checkout, performed and accepted by Engineering on 8 March 1967, gave necessary instructions for test equipment setup and manual operations performed in conjunction with automatic range safety receiver H&CO 1B59596. The purpose of this H&CO was to aid in the determination of the flight readiness of the range safety receiver system.

One revision was written which altered the non-end item equipment requirements due to unavailability of equipment.

There were no discrepancies on record.

4.1.15.6 Range Safety Receiver Checks (1B59596 D)

Initiated on 8 March and accepted by Engineering on 10 March 1967, this automatic checkout verified that the range safety receivers met or exceeded all Engineering requirements and standards of acceptance for AGC calibration and drift, minimum acceptable deviation sensitivity, and minimum acceptable RF sensitivity.

No revisions or discrepancies were recorded.

4.1.15.7 Propellant Utilization System Check (1B59481 D)

This automatic checkout provided the procedures by which the design integrity and operational capabilities of the propellant utilization (PU) system were reverified after static firing of the stage. The PU system test verified the ability of the system to determine and control the engine propellant flow mixture ratio in a manner that would ensure simultaneous propellant depletion. The test further verified that static firing had no detrimental affect on the capabilities of the system to control the LOX and LH_2 fill and topping valves and to measure propellant levels.

The test was accomplished on 10 March 1967, and was accepted by Engineering on the same date.

There were five revisions made to this drawing. One deleted steps required to feed the PU values into the computer, as these values had been recorded on paper tape during the prefire checkouts and were entered prior to the start of this test. One relocated a command to return the PU valve to the center position, as the original program could not accomplish centering. One revision corrected a program error. One increased the time between steps from 35 microseconds to 5 seconds, to allow the PU valve time to slew to the end stop before measuring the valve position. One revision repeated a step that had indicated a malfunction; however, the malfunction did not reoccur and the test continued with no other problems.

4.1.16 Hydraulic System Setup, Operation, and Securing (1B41007 A)

The purpose of this manual checkout was to provide instructions to setup, operate, and secure the stage hydraulic system, P/N 1B62563, and to maintain the system free of contaminants during operation. This procedure also checked for engine operational clearance between the engine, stage, and test stand structures while the stage was in the VCL for postfire testing.

This test procedure was initiated on 1 March 1967, and was completed and accepted on 27 March 1967.

After completion of the operational checks, the hydraulic system was prepared for shipment by depressurizing the stage air supply bottles and the accumulator/reservoir. All auxiliary equipment was removed and all sample ports were capped.

4.1.16 (Continued)

The eight revisions written during the operation of the procedure were:

a. One changed a connection point for the pressure and return hoses from the circulation disconnects on the HPU to a "U" tube assembly.
b. One deleted the Test Control Center setup requirements, as engine gimballing was accomplished by using the gimbal control unit.
c. The next change was a repeat of the accumulator/reservoir and stage air supply bottle charging. This was necessary to bring the bottle pressure to proper levels for running the all systems test being run concurrently with this procedure.
d. One changed the call out for a maintenance and calibration procedure for the nitrogen fill truck from 1A37963 to 1B56800. The 1A37963 drawing was applicable to the SIV program only.
e. One added a requirement for refilling the stage hydraulic system to replace hydraulic fluid lost overboard through the reservoir overboard vent.
f. One revision deleted another revision.
g. One added a torque value of 140 inch-pounds for bleed plug "M" on the auxiliary pump case.

4.1.17 Postfiring Thermoconditioning Checks

The forward and aft skirt thermoconditioning checks were conducted to ensure that firing the stage engine did not create any conditions detrimental to the stage. The checks were performed by the following two tests:

a. Forward skirt thermoconditioning system operating and checkout procedure.
b. Aft skirt and interstage thermoconditioning and purging system checkout.

4.1.17.1 Forward Skirt Thermoconditioning System Operating and Checkout Procedure (1B57599 C)

Initiated on 1 February 1967, and accepted by Engineering on 27 March 1967, this manual postfire checkout verified the capability of the forward skirt thermoconditioning system to provide a heat sink or heat source, as required, for the electrical/electronic equipment mounted on panels in the forward skirt.

The panels, aluminum alloy with a honeycomb core (bonded sandwich construction) and machined passages, provided a thermally conditioned water/methanol solution via the supply and return manifolds connected to the Model DSV-4B-359 thermoconditioning system servicer, P/N 1A78829-1.

Twelve revisions were written to this checkout: Five provided additional purge times to reduce the dewpoint to an acceptable level; six supplied steps

4.1.17.1 (Continued)

to prevent the backup of high pressure gaseous nitrogen into the R-12 Freon bottle supply; and one changed the acceptable dewpoint level from 25°F to 40°F.

There were no discrepancies on record.

4.1.17.2 Aft Skirt and Interstage Thermoconditioning and Purging System Checkout (1B55685 A)

This manual procedure proofed, leak checked, and reverified the functional capabilities of the stage after static firing. The test was started on 1 February 1967, and completed on 2 February 1967, without encountering any problems.

One revision was written against the procedure to delete the helium bottle shroud flow test. This test is only for the S-V configuration stage. No FARR's were generated during this test.

4.1.18 All Systems Test (1B65533 B)

The primary purpose of this checkout, conducted on 16 March 1967, and accepted by Engineering on 29 March 1967, was to verify the basic operation of all systems on the stage, i.e., electrical, hydraulic, telemetry, propulsion, etc. This checkout followed, where practical, the actual flight sequence of events which included: prelaunch operations, simulated liftoff, ullage firing, engine start, hydraulic gimballing, engine cutoff, coast period, attitude control, and shutdown.

The all systems test was conducted in a two-fold operation: The first was executed with the umbilicals connected to maintain complete control of the stage; and the second was performed with the umbilicals ejected at simulated lift-off, while all on-board systems were exercised to ensure operational capability.

Twenty revisions were written against the procedure: Twelve corrected errors in the program; five deleted portions previously accomplished; two added instructions to facilitate performance of the umbilicals-out portion; and one corrected the time data information for the auxiliary hydraulic pump.

4.1.18 (Continued)

The following FARR's were written during this checkout: A245511, Fuel Depletion Sensor; A219067, Common Bulkhead; A241916, Excessive Leakage; and A245515, Measurement Transducer M069.

4.2 Stage Checkout, Space Systems Center

Paragraph 4.2 describes the tests performed on the stage, after basic assembly and prior to shipment from Douglas SSC to STC. The stage entered tower 5 on 10 August 1966. Checkout activities consumed 39 two-shift working days between 18 August and 12 October 1966. On the latter date, the stage was turned over to Manufacturing for final inspection and preparation for shipment.

The thirty-four tests required per End Item Test Plan, 1B66532, were completed. The LOX mass probe, P/N 1A48430-509, LOX feed duct, P/N 1A49969-503, and LH_2 feed duct, P/N 1A49320-503, were short at the time of the all systems test. Interim use parts were installed for testing purposes.

Paragraphs 4.2.1 to 4.2.6 contain information on the six major areas tested: Umbilical Mechanical Mating; Environmental Control System; Electrical/Electronic Systems; Propulsion System; Hydraulic System; and All Systems.

4.2.1 Umbilical Mechanical Mating

Two test procedures were conducted to perform mechanical mating checks on the forward and aft umbilical kits. The umbilical kits are the interface link connecting the stage to GSE electrical, pneumatic, and environmental conditioning functions, and must be properly mated before stage systems tests can be conducted. The two procedures involved in this check were:

a. Umbilical kit, aft - checkout stand.
b. Umbilical kit, forward - checkout stand.

4.2.1.1 Umbilical Kit, Aft - Checkout Stand (1A57918 F)

Handling and installation of the aft umbilical kit, P/N 1A57917-1, took place on 26 August 1966, with Engineering certification on 13 October 1966.

Three revisions to the procedure included one which updated steps per EO 1A57917-1J, and two which deleted items which were either not required, or were previously accomplished.

No failure and rejection reports were prepared.

4.2.1.2 Umbilical Kit, Forward - Checkout Stand (1A57920 C)

The forward umbilical kit was installed on the stage on 26 August 1966, in preparation for automatic checkout activities.

No revisions or other deviations were noted against this procedure, which was certified by Engineering on 12 October 1966.

4.2.2 Environmental Control System Tests

Four procedures were run to ensure the integrity and operation of the forward skirt thermoconditioning system, before and after systems checkout activities, and to determine the functional capability and flow distribution of the aft skirt and interstage purge system. These procedures were:

a. Forward skirt thermoconditioning system checkout.
b. Forward skirt thermoconditioning system operation.
c. Forward skirt thermoconditioning system securing.
d. Aft skirt and interstage thermoconditioning and purge system.

4.2.2.1 Forward Skirt Thermoconditioning System Checkout (1B41926 A)

The pretesting checkout of the forward skirt thermoconditioning system, run on 22 August and accepted on 3 October 1966, prepared the system for final acceptance checkout. The ability of the system to support stage testing activities was established.

There were no revisions entered in the log sheet, and no failure and rejection reports were prepared.

4.2.2.2 Forward Skirt Thermoconditioning System Operating Procedure (1B42124 A)

The setup and operation of the Model DSV-4B-359 thermoconditioning system servicer were completed on 23 August 1966. Acceptance was made by Engineering on 13 October 1966. The servicer was used during stage system checkouts to provide water/methanol heat transfer fluid to the forward skirt electronic components area.

No revisions or functional discrepancies were written up.

4.2.2.3 Forward Skirt Thermoconditioning System Securing (1B62965 A)

Conducted and accepted on 11 and 12 October 1966, this procedure determined the system cleanliness, integrity, and readiness for stage shipment to STC.

4.2.2.3 (Continued)

The cleanliness check ensured that the water/methanol heat transfer fluid was free of contaminants, the leak check established that system leakages did not exceed allowable values, and the preparation for shipment included assurance that the system moisture level was within specified limits.

One revision noted in the log sheet pertained to drying a line in a restrictor assembly. No functional failures resulted.

4.2.2.4 Aft Skirt and Interstage Thermoconditioning and Purge System (1B40544 NC)

The proper flow distribution of the aft skirt and interstage thermoconditioning and purge system was verified between 26 and 29 August 1966.

There were three revisions in the log sheet, of which one clarified a step, one added an item which had been omitted, and one revision added two orifices, which were necessitated by the deletion of two Cannon plugs. No defects were encountered.

4.2.3 Electrical/Electronic System Tests

Eleven subparagraphs of this paragraph describe the eighteen procedures used to checkout the stage electrical/electronics systems. These subparagraphs are as follows:

a. Power distribution tests.
b. Continuity compatibility tests.
c. Propellant utilization system tests.
d. Level sensor and control unit calibration.
e. Exploding bridgewire test.
f. Range safety system tests.
g. Cryogenic temperature sensor verification.
h. Signal conditioning setup.
i. Digital data acquisition system tests.
j. Telemetry and range safety antenna system check.
k. APS simulator test.

4.2.3.1 Power Distribution Tests

The checkout of the stage forward and aft power distribution systems was accomplished, and the ability of the ACS to control stage power functions was established, by the following three procedures:

a. Stage power setup.
b. Stage power turnoff.
c. Power distribution system checkout.

4.2.3.1.1 Stage Power Setup (1B59590 B)

Verification that the ACS could activate and control stage power distribution, as well as assurance that proper loads were present on all power buses, were established on 5 September 1966. The results of testing were accepted on 7 September 1966.

The thirteen revisions to the procedure included eight which corrected program and DDT curve errors. The remaining five pertained to incorporating a circuit change per EO 1B53925K; reflecting latest dash numbers; ensuring that all cables had been installed; and agreeing with drawing 1B43561H.

There were no other discrepancies noted.

4.2.3.1.2 Stage Power Turnoff (1B59591 B)

The automatic checkout system was used to remotely shut down stage power distribution on 8 September 1966. The results were accepted on the same date, and no revisions or other discrepancies were indicated.

4.2.3.1.3 Power Distribution System (1B59592 B)

The automatic checkout of the stage power distribution system was activated on 8 September and accepted on 23 September 1966. At the same time, the ability of the ACS to control stage power switching was confirmed.

The eight revisions to the procedure included:

a. One requiring that the stage power setup test results tape remain loaded.
b. One inserting a time delay.
c. One calling out the correct setting for the SIM channel 43.
d. One calling for and describing frequency and voltage checks on the chilldown inverter.
e. One changing the procedure to comply with NASA technical directive I-V-S-IVB-64-TD-56.
f. One reflecting the rewiring of the EBW pulse sensor indicator.
g. One deleting a measurement due to a parts shortage.
h. One correcting a minor error.

No system malfunctions were encountered.

4.2.3.2 Continuity Compatibility Tests

Two test procedures were run to verify the integrity of the stage electrical wiring. The tests were:

4.2.3.2 (Continued)

a. Continuity compatibility check.
b. Umbilical interface compatibility check.

4.2.3.2.1 Continuity Compatibility Check (1B59763 D)

This procedure was run between 18 August and 1 September 1966, to establish the integrity of the stage electrical wiring. Resistance measurements were taken between connectors, and between the terminals in each connector, to accomplish this objective. The test results were accepted by Engineering on 2 September 1966. There were six revisions entered in the documentation log sheet. Two changed numerous resistance callouts, either because of variations in the length, type, and gauge of wire; or because measurements had been taken through 49.9 ohm resistance modules. New measurements were added by two revisions, because transducers D104 and D225 had been added; and because of the "F" change to drawing 1B53326. The final two revisions corrected procedural errors.

Two failure and rejection reports were written to reflect defects in stage wiring, which were discovered during this test.

FARR A216726 noted that the rubber insert in plug P16 of wire harness, P/N 1B58192-1, S/N 00004, was damaged between pins G and H. The condition was accepted for use. FARR A216727 reported on a damaged rubber insert at pin B of plug P29 on wire harness 404W7, P/N 1B58196-1. This defect was also acceptable to Engineering.

4.2.3.2.2 Umbilical Interface Compatibility Check (1B59768 A)

Conducted and accepted between 26 and 29 August 1966, the steps outlined in this document established the integrity of the stage umbilical wiring. It was demonstrated that proper loads were present on all power busses, and that the control circuits for the stage propulsion valves and safety items were within prescribed tolerances.

Two procedural revisions specified checkout of four safety items, which had been omitted from the procedure; and deleted two steps, which were no longer required.

No functional failures occurred.

4.2.3.3 Propellant Utilization System Tests

A manual calibration and an automatic checkout were conducted in conjunction with one another to verify the ability of the stage propellant utilization system to control the mixture ratio of the fuel and oxidizer propellants.

4.2.3.3.1 Propellant Utilization System Calibration (1B59826 C)

Run on 9 September and accepted by Engineering on 12 September 1966, this procedure provided the manual requirements for the calibration of the propellant utilization system. These included:

a. Verification of static inverter/converter output voltages.
b. LH_2 and LOX bridge empty and full calibration.
c. Data acquisition of the LH_2 and LOX bridge position.
d. LH_2 and LOX bridge slew checks (1/3 and 2/3 slew).
e. Reference mixture ratio (RMR) calibration.
f. LH_2 and LOX bridge linearity checks.
g. Verification of hardwire loading circuits.

Of the four revisions entered in the documentation log sheet, two corrected minor procedure errors, one noted identification of Sacramento peculiar distribution boxes, and one called for turning off a dc voltmeter to conserve test set batteries.

No malfunctions occurred while calibrating the PU system.

4.2.3.3.2 Propellant Utilization System (1B59481 B)

The operational capability of the propellant utilization system to regulate the engine mixture ratio to ensure minimum propellent residue at engine cutoff was established on 12 September 1966, after two runs. The first test run was invalidated because of incorrect cable connections from the Model 279 instrument checkout unit to the stage. The second run was completed satisfactorily with the following six revisions:

a. One revision defined the proper reference procedure.
b. One specified the correct drawing for the load ratio values.
c. A revision accounted for the rewiring of the EBW pulse sensor.
d. A measurement was deleted because a part had not been installed.
e. Two errors in the program were corrected.

No deviations requiring the preparation of failure reports were encountered.

4.2.3.4 Level Sensor and Control Unit Calibration (1B59821 C)

Between 30 and 31 August 1966, this document was used to check out the liquid level sensor systems, and the LOX and LH_2 tank overfill and fast fill sensor systems. The operating point of each sensor was set to a level well within the limits of the capacitance change created in these units by a simulated wet condition RACS command.

No revisions or other discrepancies were observed during testing.

4.2.3.5 Exploding Bridgewire System (1B59597 B)

One run was required to perform the functional checkout of the EBW system on 8 September 1966. The testing sequence was:

a. Preliminary EBW firing unit and pulse sensor test.
b. EBW firing unit pulse sensor self test.
c. Ullage rocket ignition firing unit test.
d. Ullage rocket jettison firing unit test.

The four revisions to the procedure included two correcting errors, one incorporating a circuit change per EO 1B53925K, and one deleting a measurement because parts were not installed.

No system problems were encountered.

4.2.3.6 Range Safety System Tests

The checkout of the range safety system consisted of the following three procedures:

a. Range safety receiver manual checkout.
b. Range safety receiver automatic checkout.
c. Range safety system automatic checkout.

4.2.3.6.1 Range Safety Receiver Manual Operations (1B59829 B)

Completed satisfactorily on 14 September 1966, these manual operations consisted of steps and setups, complementing the automatic H&CO 1B59596, which could not be performed automatically. Engineering certified the "as-run" results on 15 September 1966. There were seven revisions noted in the log sheet. Five corrected minor errors in the procedure, one set the mode switch to the CW position, and one reset it to the automatic configuration position.

No other deviations were encountered.

4.2.3.6.2 Range Safety Receiver Checks (1B59596 B)

Activated on 14 September and accepted on 15 September 1966, the range safety receiver checkout tested for AGC calibration and drift, minimum acceptable deviation sensitivity, and minimum acceptable RF sensitivity, before the system checkout was performed. Manual H&CO 1B59829 was performed in conjunction with this test.

There were seven revisions noted in the documentation log sheet, of which three corrected program errors. One added items which had been omitted; one set a breakpoint; one deleted a measurement due to a parts shortage; and one changed the procedure per NASA technical directive I-V-S-IVB-64-TD-56.

No defects were noted.

4.2.3.6.3 Range Safety System (1B59482 B)

The functional verification of the range safety system took place on 15 September 1966, and was accepted on 21 September 1966. One run was required to accomplish this task, which was composed of the following segments:

a. EBW and receiver external/internal power transfer test.
b. Engine cutoff test.
c. Pulse sensor and propellant dispersion command inhibit test.
d. In-flight turnoff command test.
e. Arm and engine cutoff command test.
f. Propellant dispersion command test.
g. Safe and arm device test.

Eleven revisions were recorded in the log sheet, as follows:

a. Two were written to account for rewiring the EBW pulse sensor indicator.
b. Two revisions corrected program errors.
c. The procedure was changed by one revision per NASA letter R-QUAL-P/DAC-387-66.
d. Two measurements were deleted; one because of a parts shortage, and the second because it was no longer required.
e. Two revisions pertained to the setup of ground support equipment.
f. Two revisions set breakpoints where necessary.

There were no failure and rejection reports prepared.

4.2.3.7 Cryogenic Temperature Sensor Verification (1B59818 B)

Those temperature transducers for which the normal operating range did not include ambient (room) temperature were checked out per this procedure

4.2.3.7 (Continued)

between 26 August and 28 September 1966.

No revisions to the procedure were noted in the log sheet; however, two failure and rejection reports were prepared as a result of discontinuities discovered. FARR A216728 noted that there was no continuity between pins B and E of plug 404W208 P45, of LOX probe, P/N 1B41769-401. The probe was removed and replaced. FARR A216729 reported that no continuity existed between pins 2 and 3 of plug 403A200 J4, P/N 1B58136. The plug was disassembled and no wiring defect was found. It was then reassembled, and continuity was established.

4.2.3.8 Signal Conditioning Setup (1B59822 C)

Run between 29 August and 20 September 1966, the signal conditioning setup served to calibrate all signal conditioning equipment, when it was found out-of-tolerance; or when a component was replaced and found out-of-tolerance. It was also used to troubleshoot instrumentation problems during computer holds, and to verify the calibration of the 5 vdc and 20 vdc excitation modules. The data obtained in testing per this document were accepted by Engineering on 7 October 1966.

There were six revisions entered in the log sheet. One added an item omitted from the procedure; two corrected minor errors; one changed the procedure to agree with IPCL drawing 1B43561F; one changed steps to comply with production test drawing 1B27777; and another revision added a test cable which was compatible with the 5 vdc excitation module.

No malfunctions were noted during the test.

4.2.3.9 Digital Data Acquisition System Tests

The digital data acquisition system was operationally examined and checked out through the performance of two calibration procedures, one manual and one automatic, followed by an automatic system checkout procedure. These

4.2.3.9 (Continued)

procedures verified that the PCM/FM/FM portion of the stage telemetry system, including all multiplexers and submultiplexed channels, were operating properly. These procedures were:

a. DDAS calibration, manual operations.
b. DDAS calibration, automatic
c. DDAS automatic checkout.

4.2.3.9.1 Digital Data Acquisition System Manual Calibration (1B59823 C)

Those manual operations required for the calibration of the PCM/FM/FM digital data acquisition system were performed between 1 and 7 September 1966, with acceptance taking place on 12 September. A second issue, run because the remote analog submultiplexer, P/N 1B54062-503, had been replaced (reference FARR A216730), was completed and accepted on 21 and 22 September 1966, respectively.

There were eight revisions to the first issue, including three adding the Model 726 electrical checkout adapter accessory kit, and five adding a Model PD3650 power supply to check out the 20 vdc power sources.

The two revisions to the second issue pertained to provisions for re-testing the RASM.

FARR A216730, referenced above, is further detailed in paragraph 4.2.3.9.3.

No other malfunctions were noted.

4.2.3.9.2 Digital Data Acquisition System Automatic Calibration (1B59593 B)

Conducted in conjunction with manual calibration H&CO 1B59823, this procedure verified that the components of the PCM/FM/FM system were within specified tolerances. The test was run between 1 and 7 September 1966, incorporating the following sixteen revisions:

4.2.3.9.2 (Continued)

a. Four noting that the system was to be tested to the -503 configuration test requirements.
b. Three deleting steps which were no longer required, and one deleting a measurement because of a parts shortage.
c. Four revisions adding the Model 726A electrical checkout adapter and the Model 296 telemetry signal distribution unit to the list of end item test equipment.
d. Two changing part numbers to bring the procedure up to date.
e. A revision corrected an error, and another reflected rewiring of the EBW pulse sensor.

Failure of RASM, P/N 1B54062-503, to sync when troubleshooting a temperature measurement resulted in its replacement (reference FARR A216730). This necessitated a reissue of the procedure, in order to verify the calibration of the RASM. This second issue, completed on 21 September 1966, incorporated three revisions. One of these authorized the rerun, one corrected an error, and one noted the rewiring of the EBW pulse sensor.

FARR A216730, reporting on the above mentioned RASM, is detailed further in paragraph 4.2.3.9.3. No other defects were noted.

4.2.3.9.3 Digital Data Acquisition System (1B59594 C)

Four runs were required before the DDAS automatic checkout could be completed on 22 September 1966. The first three runs were incomplete due to various necessary adjustments, to program errors, and parts shortages. The remote analog submultiplexer, P/N 1B54062-503, was replaced prior to the final run.

All channels having signal insertion capability were compared, one at a time, to their tolerance limits, using the D924A computer. Channels without RACS capability were compared to their tolerance limits at ambient conditions. The results of this testing were accepted by Engineering on 30 September 1966.

The following thirty-one revisions appeared in the revision documentation log sheet:

4.2.3.9.3 (Continued)

a. Ten corrected errors in the procedure or program, four added items which had been omitted, and two clarified the procedure.
b. A revision specified power supply requirements for additional hardwire measurements.
c. One revision accepted indications of excessive noise which were due to high gain of the RASM.
d. A parts shortage caused a measurement to be deleted.
e. Two revisions pertained to the rewiring of the EBW pulse sensor indicator.
f. Another revision pointed out that the hydraulic system had been pressurized during the course of this test.
g. Another specified the use of an AC voltmeter and counter.
h. Portions of the procedure were rerun per two revisions, after a PCM malfunction and after a transducer was replaced.
i. One revision corrected a drawing number.
j. Two added necessary time delays.
k. A revision provided for the insertion of actual log book values.
l. One set the PAM ground station in the correct mode.
m. Another called for verification that all channels were RACS tested.

Two failure and rejection reports were written during the course of testing per this procedure. FARR A216730 reported that remote analog submultiplexer, P/N 1B54062-503, S/N 018, failed to sync. The unit was found to be acceptable upon retest. FARR A216734 noted that transducer, P/N 1B40242-533, S/N 533-12, was intermittent. Retest failed to reproduce the defect, and the transducer was accepted for use.

4.2.3.10 Telemetry and Range Safety Antenna System (1B59819 B)

The function of the telemetry and range safety antenna system was verified between 24 August and 2 September 1966, with Engineering acceptance of the results taking place on 12 September 1966.

The eighteen revisions to the procedure included:

a. One complying with new data requirements.
b. Five adding items omitted from the procedure.
c. Five making minor procedural corrections, and three clarifying the procedure.
d. Two revisions widened tolerances, and two pertained to modifying a Z-Theta table.

No malfunctions were noted.

4.2.3.11 APS Simulator Test (1B59601 B)

Conducted and accepted on 9 September 1966, this test established that a suitable electrical interface existed between the stage and the APS modules. For purposes of testing, APS module electrical simulators, Model DSV-4B-188, were employed in place of the actual modules. Included in the test sequence were:

a. Verification that bus power could be applied, and that static loads were not excessive.
b. Verification that attitude control commands from the IU controlled the proper sets of quad-redundant solenoids.
c. Verification of the telemetry system associated with the APS.

Of the six revisions to the procedure, two corrected errors, two enabled the operator to manually test the APS relay modules, one set a break-point, and the final revision added an item which had been omitted.

No functional failures were encountered.

4.2.4 Propulsion System Tests

Eight procedures were required to completely verify the function and integrity of all propulsion system components. The eight tests were:

a. Propulsion system control console.
b. LH_2 tank pressurization system leak check.
c. Pneumatic control system leak check.
d. Cold helium system leak check.
e. Propellant tanks assembly leak check.
f. J-2 engine system leak check.
g. Engine alignment procedure.
h. Propulsion system automatic checkout.

4.2.4.1 Propulsion System Control Console/Stage Compatibility (1B59427 A)

On 1 September 1966, this procedure was conducted to verify that actuation of electrical command switches on the propulsion system control console resulted in proper solenoid responses on the stage. The results were accepted by Engineering on 21 September 1966, on which date the LOX pre-valve and LH_2 vent valve were installed and tested.

No revisions or functional failures were noted.

4.2.4.2 LH_2 Tank Pressurization System Leak Check (1B59429 A)

Examination of the fuel tank pressurization system for leakage was accomplished manually between 12 and 20 September 1966.

4.2.4.2 (Continued)

Of four leakage entries in the leak check log, two were cleared by replacing conoseals, one by replacing a union, and one by retightening a B-nut to the proper torque value.

Three revisions to the procedure included two which described measurement of the internal and reverse leakage of check valve, P/N 1B55673-1; and one that deleted a line which was no longer required.

There were no functional failures requiring the preparation of failure and rejection reports.

4.2.4.3 Pneumatic Control System Leak Check (1B59430 A)

Verification of the leak free condition of all pneumatic system lines, components, and fittings was achieved between 15 and 26 September 1966. Sixteen leakage conditions were noted in the leak check record sheet, of which ten were repaired by retightening B-nuts to the proper torque value. One Naflex seal, two unions, one adapter, and one bulkhead fitting were replaced. A leak in pipe assembly, P/N 1B58811-1, at the LH_2 prevalve, was repaired by installing a Voi-Shan seal, P/N SO-254A4, per FARR A216732.

The revision documentation log sheet contained five revisions. Two pertained to adding check valve internal leakage checks; two involved internal leak checks of shutoff valves; and one corrected a minor error in the procedure.

No other discrepancies were observed.

4.2.4.4 Cold Helium System Leak Check (1B59431 A)

The leak check and mechanical setup of the cold helium LOX tank pressurization system was accomplished between 15 and 29 September 1966, with Engineering acceptance taking place on 10 October 1966.

Of the six entries in the leak check log sheet, two were corrected by retightening B-nuts to the proper torque value, one by replacing an O-ring and seal, one by replacing a cap, and one by installing a Voi-Shan seal. A leak in manifold assembly, P/N 1A68668-503, at the B-nut to helium

4.2.4.4 (Continued)

bottle No. 4, was recapped on FARR A216731. A crush washer was installed, and the nut was tightened to the proper torque value. There were two revisions in the documentation log sheet. One described an internal leak check of check valve, P/N 1B40824-503, and the other corrected a minor error in the procedure.

No other defects were found.

4.2.4.5 Propellant Tanks System Leak Check (1B59432 NC)

Between 30 September and 10 October 1966, the manual leak checks of the propellant tanks assembly, as well as the vacuum checks of the vacuum jacketed ducts and the common bulkhead vacuum system, were performed.

Of the seven revisions described in the documentation log sheet, one changed the document as necessary to account for the use of GHe instead of GN_2/freon as the pressurant gas. Three revisions pertained to the use of modified pressure adapters; one clarified the procedure; and two deleted items because an area was inaccessible, or because they were no longer necessary.

No leakage conditions were noted in the leak check log, and no other defects were discovered.

4.2.4.6 J-2 Engine System Leak Check (1B59433 A)

The manual leak check of the J-2 engine system, ran and accepted between 19 September and 10 October 1966, consisted of two distinct procedures, as follows:

a. The J-2 engine leak check consisted of tests on the start sphere, the control sphere, and the pneumatic lines.
b. The thrust chamber leak check involved pressurizing the chamber and checking its integrity. In this portion of the test, the engine part of the LH_2 tank pressurization system was leak checked.

Two revisions to the procedure included one changing the document to comply with design memo 190 C, and one inserting bleed valve pressure relief after engine shutdown.

4.2.4.6 (Continued)

The only entry in the leak check log, a leak in pipe assembly, P/N 1B52566-1, was corrected by the installation of a Voi-Shan seal per FARR A216733.

4.2.4.7 Engine Alignment (1B39095 A)

Performed and accepted on 24 August 1966, the engine alignment procedure contained instructions for measuring and adjusting actuator lengths, and verifying engine alignment while the stage was in a vertical attitude.

No revisions or discrepancies were written against this test.

4.2.4.8 Propulsion System Test (1B64390 B)

The five major portions of the propulsion system were tested individually, as follows:

a. The LH_2 tank pressurization system was functionally checked on 27 September 1966. The test was run twice because numerous program errors required termination of the first run. These errors were corrected through revisions.
b. The operational evaluation of the pneumatic control system was activated and completed on 27 September 1966, with no problems encountered.
c. Checkout of the J-2 engine system, performed on 27 and 28 September 1966, was accomplished after five runs. Early runs were terminated because of a GSE problem and various program errors, all of which were solved by the final run.
d. The LOX tank pressurization system test was completed on 29 September 1966, after two runs. The first run was interrupted by a GSE power supply failure. No other difficulties were observed.
e. On 29 September 1966, the functional checkout of the pressure switches was run with no problems occurring.

There were a total of thirty revisions to this procedure. They were:

a. Six deleted items which were no longer required.
b. Four added necessary time delays to complete functions.
c. Thirteen corrected errors in the procedure and program, one clarified the procedure, and one added an item which had been omitted.
d. The remaining five revisions pertained to a changed calibrated transducer psia; adding a "do not intervene" command; widening a tolerance; accounting for operational pressure; and deleting a flex hose not required for pressure switch checkout.

4.2.5 Hydraulic System Tests

The function, cleanliness, and integrity of the hydraulic system components and hardware were verified using the following two procedures:

a. Hydraulic system fill, flush, bleed, and fluid samples.
b. Hydraulic system automatic checkout.

4.2.5.1 Hydraulic System Fill, Flush, Bleed, and Fluid Samples (1B40973 B)

Performed between 12 and 30 September and accepted on 13 October 1966, this procedure defined the operations required to set up the system for automatic checkout. This included checkouts of hydraulic pressure, system cleanliness, fluid temperature, and transducers.

There were twenty-one revisions appearing in the log sheet, including eleven which changed the procedure because the gimbal control unit had been reworked. Five items were deleted because either they were no longer required, or parts were short, or the GSE setup had not been completed. One revision added a new jumper hose, one incorporated new request numbers, one changed the order of the procedure, and two revisions were voided.

There were no other discrepancies noted.

4.2.5.2 Hydraulic System (1B59485 B)

The functional checkout of the hydraulic system, ran on 26 and 27 September, and accepted on 30 September 1966, was completed after two runs. The first run was inconclusive due to a GSE malfunction, and program errors. These problems were solved prior to the second run. The general test sequence included:

a. Accumulator precharge test.
b. Reservoir oil volume test (unpressurized).
c. Reservoir oil pressure test (unpressurized).
d. Coast mode thermal switch test.
e. Mid-stroke lock tolerance check.
f. System pressure test (pressurized).
g. Reservoir oil pressure test (pressurized).
h. Reservoir oil volume test (pressurized).
i. Polarity, linearity, and clearance tests.
j. Transient response test.
k. Frequency response test.

4.2.5.2 (Continued)

There were eighteen revisions to the procedure noted in the log sheet. Five of these corrected program errors, and two deleted steps which were no longer required. The remainder of the revisions pertained to using the Offner recorder; cycle significance of the engine gimbal; correcting the halves balance ratio limit printout; replacing a 2^{o} step with a 3^{o} step; slew rate printout; a part number change; a time delay; an out of service GSE power supply; and rewiring of the EBW pulse sensor.

There were no functional failures observed.

4.2.6 All Systems Test (1B59609 C)

The all systems test simulated the situations facing the stage during prelaunch, launch, powered flight, and coast conditions. On 4 October 1966, those portions of the test which preceded simulated liftoff were run. For these activities, the stage was connected to facility power and air conditioning sources through the umbilical. The umbilicals were removed on 5 October 1966, for the remainder of the program. Final test results were accepted by Engineering on 12 October 1966.

Forty-eight revisions to the procedure appeared in the revision documentation log sheet. Of these, eight corrected errors, five added items which had been omitted, and ten deleted steps which were no longer required. The remaining were:

a. One covering a special cable installation.
b. One accounting for range safety antenna noise.
c. One noting that there were seven CW tone switches.
d. Nine inserting time delays as necessary.
e. Eight correctly setting up test equipment.
f. One closing the servo control unit so that the VCO could operate.
g. One widening a tolerance.
h. Two achieving compatibility with the DDAS closed loop.
i. One revision written in error was voided.

No failure and rejection reports were prepared as a result of the all systems test.

4.3 Stage Manufacturing Tests

All manufacturing and test records for the stage are reviewed and presented in this paragraph. Also included are those procedures pertaining to

4.3 (Continued)

preparation of the stage for shipment to STC. Table II contains narrated descriptions of the permanent nonconformances recorded on FARR's during manufacturing and test, while those nonconformances discovered during final inspection and pre-shipment activities are narrated in Table I, Section 3. The dispositioning of these FARR's was accomplished by the Material Review Board. A review has been made of acceptance test data pertaining to the weight, balance, and shipment requirements, hydrostatic proof tests, and subsequent leak check of the propellant tanks.

4.3.1 Stage Preparation for Shipment

Five procedures were conducted to prepare the stage for shipment, by transporter, to Los Alamitos Naval Air Station, and by Super Guppy from there to Sacramento. These were:

a. Stage preparation for air transportation.
b. Stage transportation, transporter, air carry pallet.
c. Stage loading, air carrier.
d. Stage preparation for weigh and balance.
e. Weigh and balance.

4.3.1.1 Stage Preparation for Air Transportation (1B57355 B)

The support and handling equipment necessary to ship the stage, by Super Guppy, from SSC to STC was installed in the following sequence:

a. Installation of the air carry roller transfer kit onto the transporter.
b. Installation of the air carry support assembly (pallet) onto the transporter.
c. Installation of the stage hoist equipment.
d. Loading the stage onto the air carry support assembly/ transporter.

Performed on 2 December 1966, there was one revision to the procedure deleting the provisions that certain hardware items be shipped along with the stage, as it was not necessary to re-install these items at STC. No functional failures were noted.

4.3.1.2 Stage Transportation, Transporter/Air Carry Pallet (1B57356 A)

The transportation of the stage, when secured to the air carry pallet/ transporter, from Douglas SSC to NAS Los Alamitos, was accomplished as follows:

4.3.1.2 (Continued)

a. Transporter checkout procedure.
b. Prime mover to transporter hook-up.
c. Stage transportation procedure.
d. Prime mover to transporter disconnect.

Performed on 2 December 1966, the ground transportation procedure was completed with no revisions or functional failures.

4.3.1.3 Stage Loading, Air Carrier (1B57357 C)

The final operation in the process of preparing the stage for air transportation to STC involved:

a. Transferring the stage, with its pallet, from the transporter to the cargo lift trailer (CLT).
b. Positioning the CLT, with the stage, in preparation for loading into the air carrier.
c. Loading the stage, on its pallet, into the air carrier.
d. Removing the ground support equipment.
e. Approval of flight status.

The loading procedure took place on 2 December 1966, and was modified by five revisions as follows:

a. One specified that four NAS 1338A5S18 pins instead of two were to be used to attach adapters to the roller transfer kit.
b. One revision noted that only two load binders, rather than four, were required to secure the CLT.
c. A revision noted that the aft support ring was replaced by the air carry pallet.
d. One revision indicated that tiedowns had been replaced by the roller transfer kit.
e. A final procedure revision added a safety item which had been omitted.

No functional failures were encountered.

4.3.1.4 Preparation for Stage Weigh and Balance (1B37831 C)

The stage was prepared for horizontal weighing and balancing operations on 28 November 1966, according to the following sequence:

a. Installation of stage handling rings.
b. Preparation of the weighing area in the VCL.
c. Installation of stage and handling rings on cradles.
d. Installation, checkout, and removal (after weighing operation) of weighing equipment.
e. Installation of stage support assembly (engine protective cover).

4.3.1.4 (Continued)

f. Installation of the stage, with rings and cradles, on the transporter.

The preparation was completed with no revisions or functional failures reported.

4.3.1.5 Weigh and Balance (1B64539 B)

The weigh and balance procedure defined the method for measuring the weight of the stage in such a manner that the longitudinal center of gravity could be determined from the results. The accuracy of these measurements was within ± 0.1 per cent.

The stage weight in air was found on 29 November 1966, to be 23,749.0 pounds, and the weight corrected for Standard Locality in a vacuum was 23,804.7 pounds. The longitudinal center of gravity was found to be located at station 335.02.

There were five revisions to the weigh and balance procedure, including three deleting items which were no longer required. One called for Engineering to determine the configuration status of the stage at weighing time, and one clarified a step.

No malfunctions were noted.

4.3.2 GN_2 - Electrical Preshipment Purge, Air Carry (1B65782 D)

The activities required to ready the stage for air shipment to STC were completed on 29 November 1966. These activities included purging and drying the stage to a -30°F dewpoint (235 ppm by volume), and connecting the desiccant breathing assemblies to provide a clean, dry, and safe differential pressure environment during air carry.

No revisions to the procedure were included, and there were no functional failures.

4.3.3 Final Inspection

A final inspection was performed on all mechanical and electrical areas between 7 and 11 November 1966, before the stage was weighed and prepared for shipment. There were 117 discrepancies noted, of which 54 were

4.3.3 (Continued)

mechanical and 63 were electrical. The mechanical discrepancies were minor deviations including loose or missing parts, bolts too short or too long, parts riding the structure or one another, areas needing cleaning or paint, damaged parts, valves not safetied, and lack of evidence of identification or torque. The electrical problems, also minor, were loose wire harnesses, damaged wires, connections improperly served, wires improperly stored, cables riding the structure, chaffing, missing, or excess parts. All problems were resolved, and rework was completed, with the exception of four discrepancies, as follows:

a. FARR A216708 noted that pipe assembly, P/N 1B58657-507, was kinked 1/4 in. behind the B-nut that connected to pipe assembly, P/N 1B38424-503. The defective pipe assembly was removed and replaced.
b. FARR A216709 reported on a 3/8 in. x 1/4 in. x 0.030 in. ding in the non-propulsive vent duct, P/N 1A87436-501. The defect was accepted for use.
c. Per FARR A216711, the cable assembly on transducer 410MT601, P/N 1B40242-55, S/N 509-18, had torn insulation in two places, exposing the shield. The damaged areas were tension spiral wrapped with teflon tape per DPS 54010. The rework was acceptable.
d. FARR A216712 reported on numerous aft skirt stringer caps installed in a preloaded condition. All were accepted for use, except the cap at stringer 78, which was cracked. It was removed, and replaced per B/P.

4.3.4 Propellant Tank Leak and Hydrostatic Proof Tests

The propellant tank hydrostatic proof tests were conducted to discover leakages and stress patterns in a differential pressure environment. The tank assembly was subsequently leak checked using halogen, helium, bubble solution, and dye penetrant methods.

4.3.4.1 Propellant Tanks Hydrostatic Proof Test (1B38414 A)

Run on 22 March 1966, the hydrostatic proof checkout of the propellants assembly determined its stress patterns, and ensured its structural integrity. The test was conducted per acceptance test procedure A659-1B38414-1-PATP8, and consisted of the following:

a. Proof of the common bulkhead to a positive (internal) pressure differential of 27.5 + 0.5, -0.0 psi, and the LOX tank at the common bulkhead joint to 28.7 + 0.5, -0.0 psi.

4.3.4.1 (Continued)

b. Proof of the common bulkhead to a negative (external) pressure differential of -20.6 + 0.0, -0.5 psi, and the LH_2 tank at the common bulkhead joint to 22.5 + 0.5, -0.0 psi.
c. Proof of the LOX tank to a positive (internal) pressure differential of 51.0 + 0.5, -0.0 psi, and the common bulkhead at the aft dome joint to 19.2 + 0.5, -0.0 psi.
d. Proof of the LH_2 tank to 38.0 + 0.5, -0.0 psi, and the common bulkhead to aft dome joint to a positive (internal) pressure differential of 5.2 + 0.0, -0.5 psi.

There were no revisions or functional failures recorded.

4.3.4.2 Leak Check

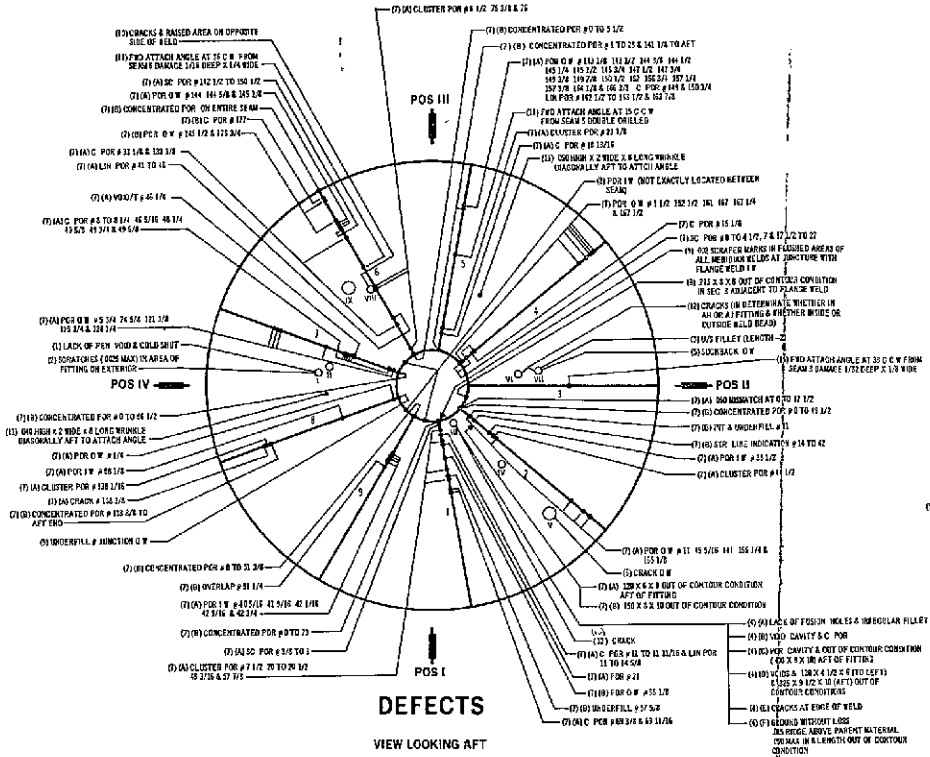
The propellant tanks assembly was leak and dye checked, subsequent to hydrostatic testing, to ensure the structural integrity of its components and welds. Direction and results of these tests were recorded on Quality Engineering Charts (QEC), which are included in the Stage Log Book.

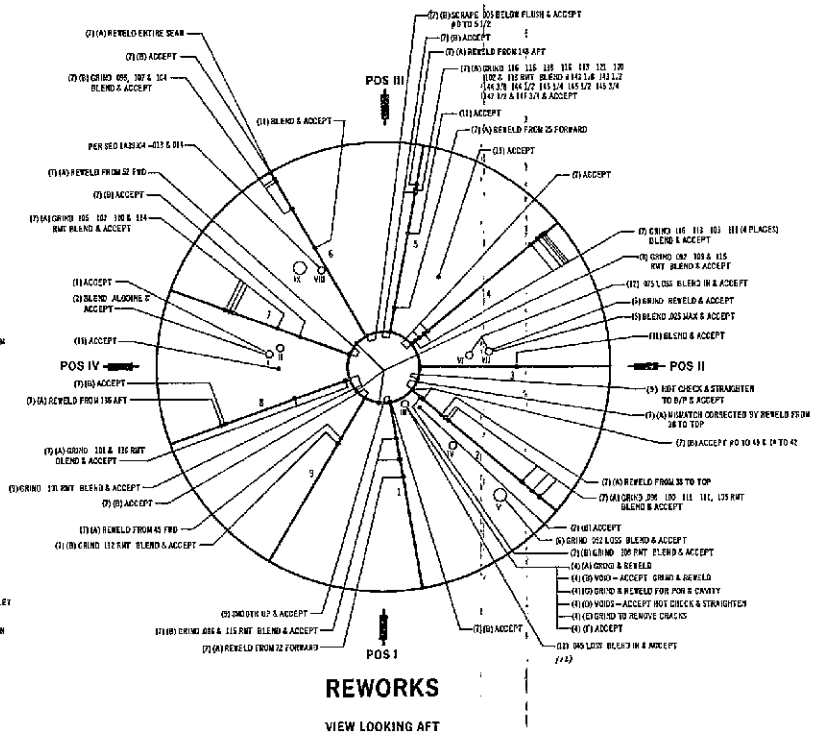
QEC papers 751, 753, 754, 755, 756, 757, 759, 761, 794, 1520, 1521, 1522, 1523, 1524, 1537, 1553, 1554, 1555, 1556, 1557, and 1558 were used for the halogen, helium, and bubble solution leak checks. FARR A192991 noted that the common bulkhead joint could not be pressurized to 46 ± 2 psi per DPS 40014. After several applications of 1P20057 sealant, numerous blind bolt core holes were filled. The dye checks of all tank welds were conducted per QEC's 799, 902, 903, 904, 905, 908, 915, 916, 917, 920, 921, 924, 935, 968, 986, 1579, 1580, 1684, 1687, 1691, 1693, 1694, 1695, 1696, and 1697. Most of these tests revealed No. 1 and 2 porosities in several tank welds; however, these indications were acceptable per dye check inspection. Two failure and rejection reports were written against conditions which could not be immediately corrected. They were:

a. FARR A177071 noted that dye check of the forward dome seams and fitting welds revealed star cracks at fittings R-R and C-C, and greater than No. 3 porosity in seam 1. All defects were ground out and accepted for use.
b. FARR A209538 reported that dye penetrant inspection of the common bulkhead ring weld revealed No. 3 porosity in several locations. The porosities were ground out and accepted for use.

5.0 POSTRETENTION

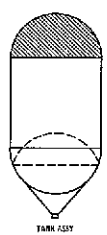
The information in this section will be added 21 days after the stage is shipped from STC.





LEGEND

I BRACKET TEE
II #1/8 LEAD OUT WIRE PORT
III VENT SEPARATOR
IV CLIP LH VENT LINE
V VENT LINE PORT
VI PRESS SENSOR
VII PRESS PORT
VIII BRACKET TEE
IX #10 WIRE LEAD OUT PORT



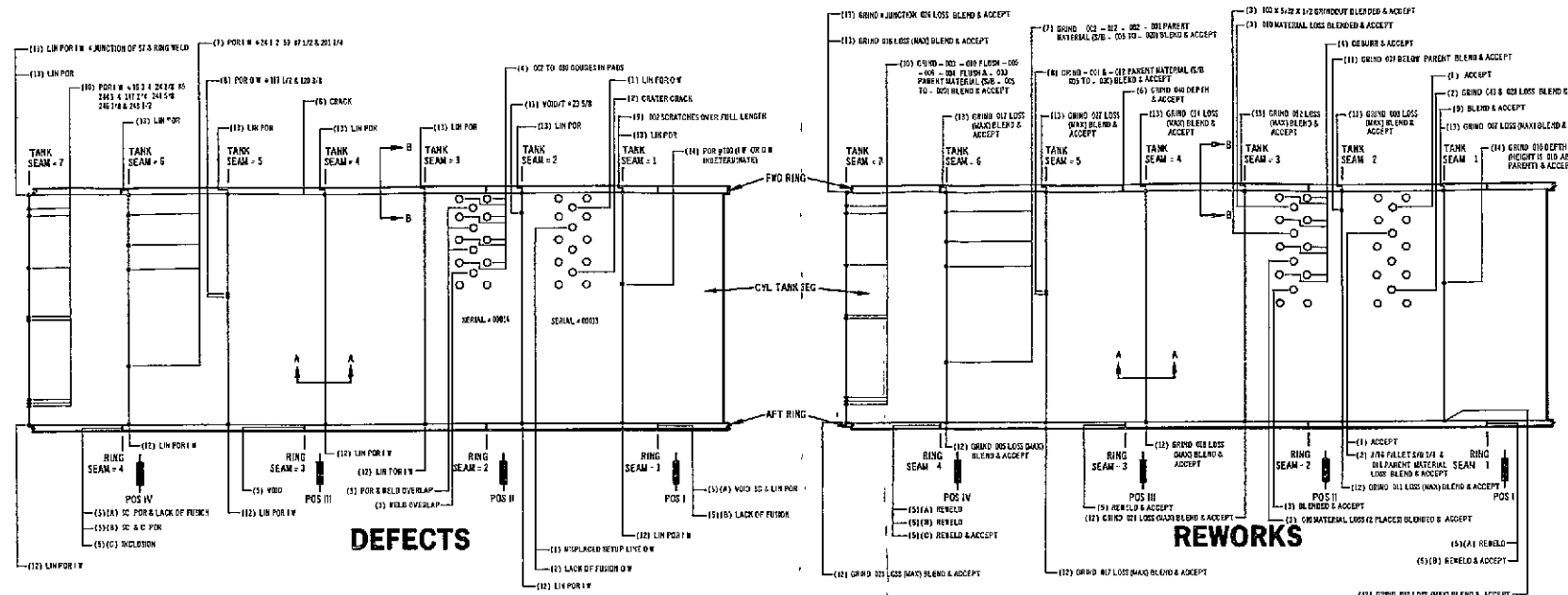
ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	HOW REWORKED	REWELDS
1	A182660 AE	1-23-66	3	0	N/A	0
2	A1120S9 AE	1-23-66	1	1	N/A	0
3	A182649 AH	1-23-66	1	1	AUTO TIG	1
4	A182580 AD	1-24-66	18	5	AUTO TIG	5
5	A182582 AH	1-25-66	2	2	N/A	0
6	A182527 FF	1-25-66	1	1	N/A	0
7	A182623 WJH	1-31-66	150	43	AUTO #10	5
8	A182535 FL	2-17-66	3	3	N/A	0
9	A182532 WS	2-16-66	3	3	N/A	0
10	A182544 AK	2-23-66	2	1	N/A	0

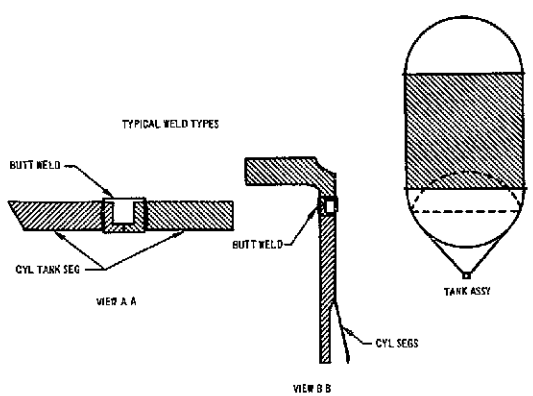
ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS
11	A182533	2-16-66	5	2	N/A	0
12	A182071	1-3-66	7	2	2	0

FOLDOUT FRAME 1

FOLDOUT FRAME 2

Chart 1. Forward Dome Assembly





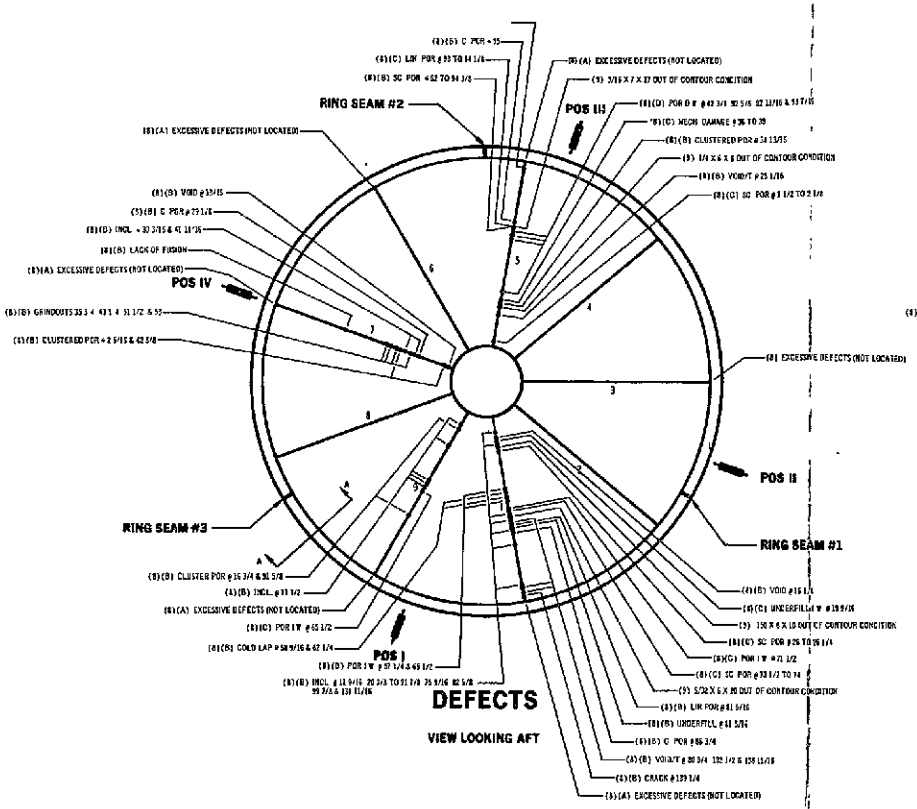
ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS
(1)	A171525	10-30-65	2	0	N/A	0
(2)	A171527	11 1 65	3	3	N/A	0
(3)	A171530	11 3 65	7	7	N/A	0
(4)	A171535	11 17 65	8	8	N/A	0
(5)	A171594 BEFORE MACHINING	12 7 65	9	0	MANUAL WRK	9
(6)	A127661 BEFORE MACHINING	12 15 65	1	1	N/A	0
(7)	A126594*	1 2 66	4	4	N/A	0
(8)	A118696	1 3 66	2	2	N/A	0
(9)	A171522	1 9 66	1	1	N/A	0
(10)	A171525	1 13 66	8	8	N/A	0

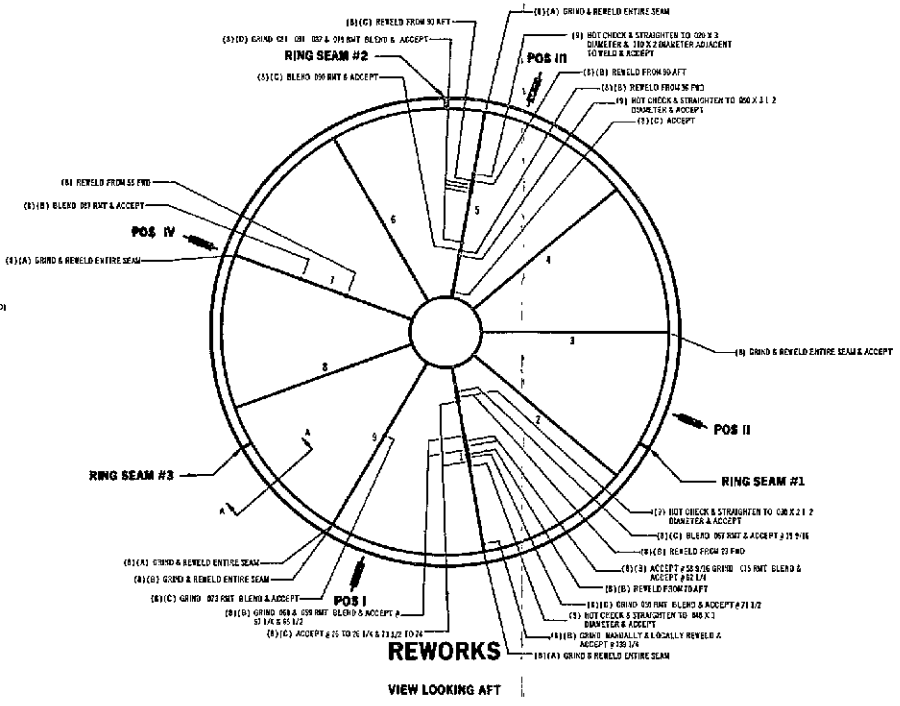
ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS
(11)	A177074	1 18 66	1	1	N/A	0
(12)	A184091	2 2 66	7	7	N/A	0
(13)	A184092	2 3 66	8	8	N/A	0
(14)	A177071	4 3 66	1	1	N/A	0

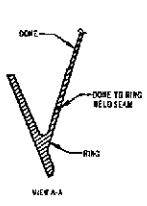
FOLDOUT FRAME 1

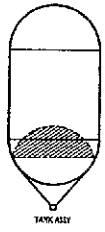
FOLDOUT FRAME 2

Chart 2. Cylindrical Tank Assembly









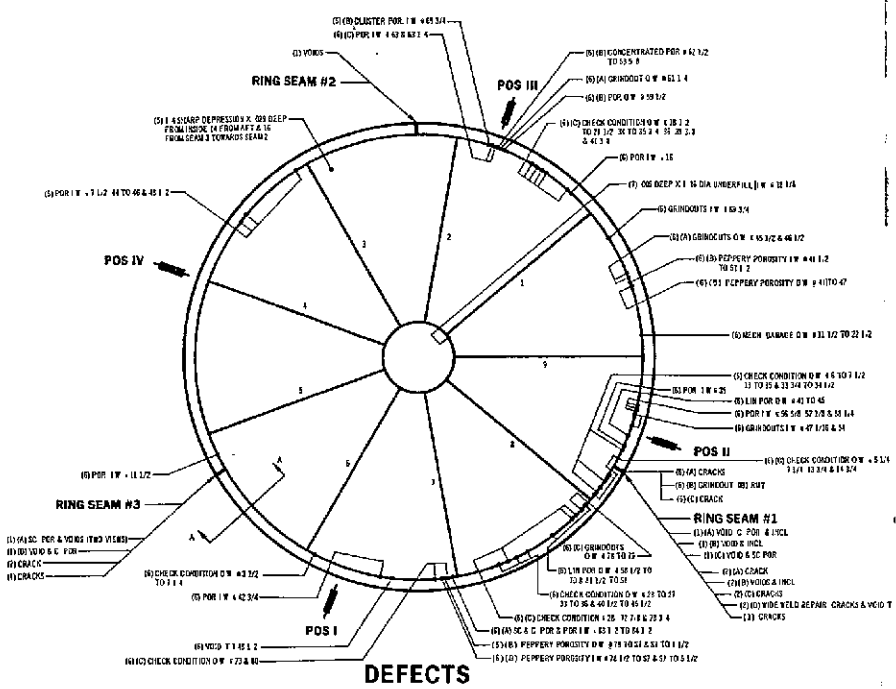
ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	HOW REWORKED	REWELDS
(8)	A139977 (SEAM 3)	6-14-65	14	11	MANUAL & AUTO MIG	4
(6)	A139977 (SEAM 3)	6-14-65	1	1	AUTO MIG	2
(5)	A139991 (SEAM 2)	6-14-65	13	3	AUTO MIG	4
(3)	A139991 (SEAM 2)	6-14-65	12	3	AUTO MIG	2
(1)	A139977 (SEAM 1)	6-14-65	9	3	AUTO MIG	2
(9)	A142547 (SEAM 1 & 5)	7-1-65	1	1	N/A	0

ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS

FOLDOUT FRAME 1

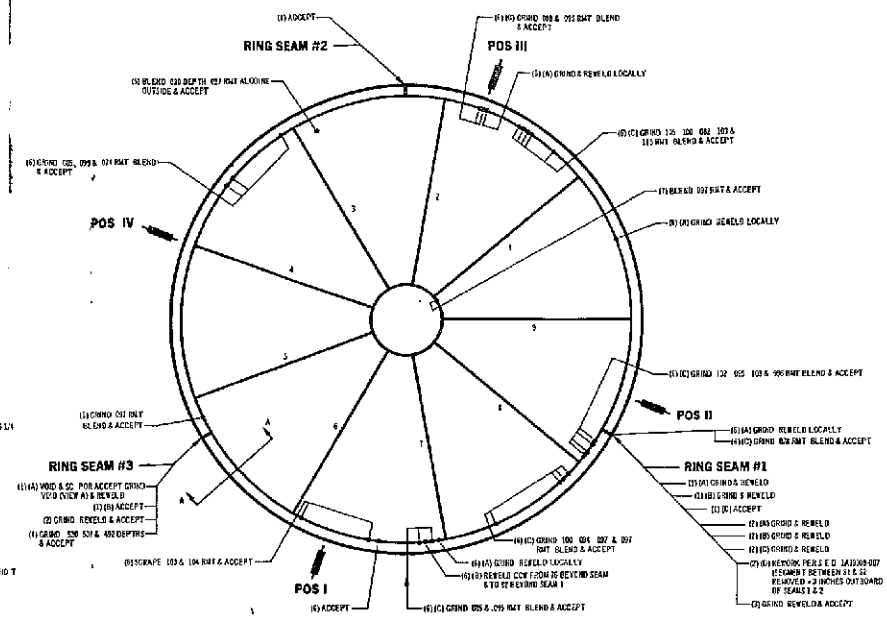
FOLDOUT FRAME 2

Chart 3. Forward Face Meridian Welds



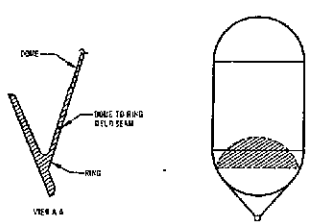
DEFECTS

VIEW LOOKING AFT



REWORKS

VIEW LOOKING AFT



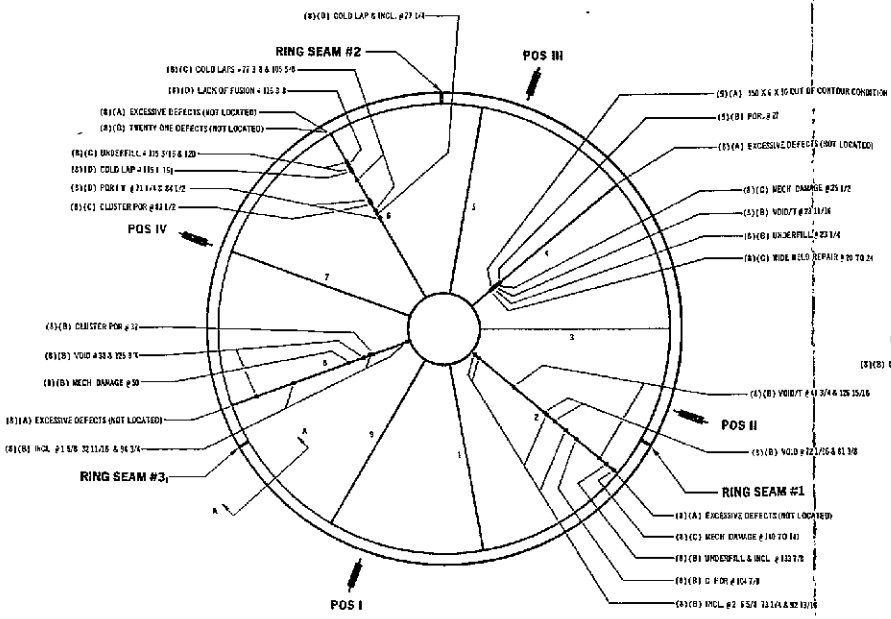
ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	HOW REWORKED	REWELDS
1	A125955 BEFORE MACHINING	3-15-65	13	3	MANUAL MIG	3
2	A125502 AFTER CHECK & STRAIGHTEN	3-29-65	8	5	MANUAL MIG	5
3	A125615-002 AFTER CHECK & STRAIGHTEN	4-5-65	1	1	MANUAL MIG	1
4	A125955 AFTER MACHINING	5-7-65	7	3	N A	0
5	A125959	5-25-65	1	1	N A	0
6	A130003 RING TO DOME	7-8-65	51	29	AUTO MIG	5
7	A155224 CP	7-22-65	1	1	N A	0

FOLDOUT FRAME 1

ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS

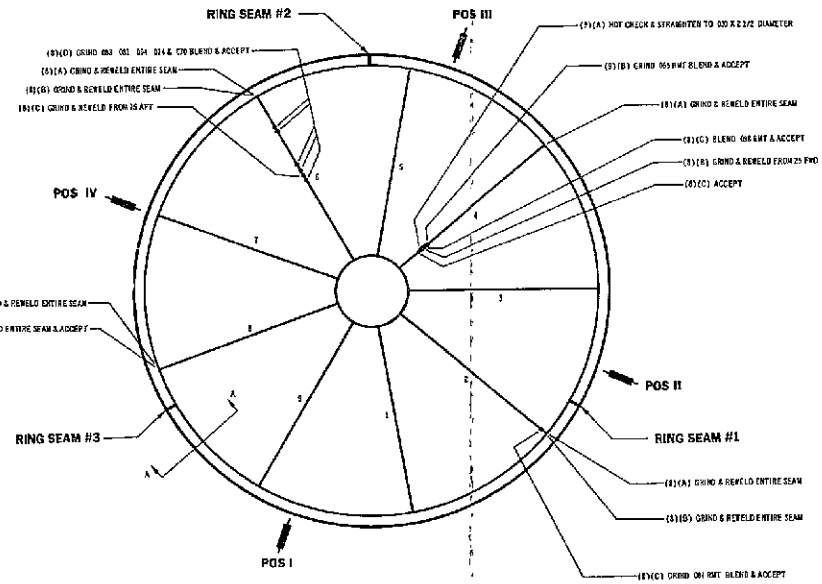
FOLDOUT FRAME 2

Chart 4. Forward Face Ring and Plate Welds



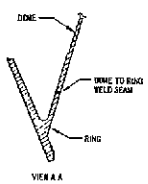
DEFECTS

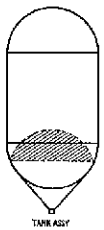
VIEW LOOKING AFT



REWORKS

VIEW LOOKING AFT





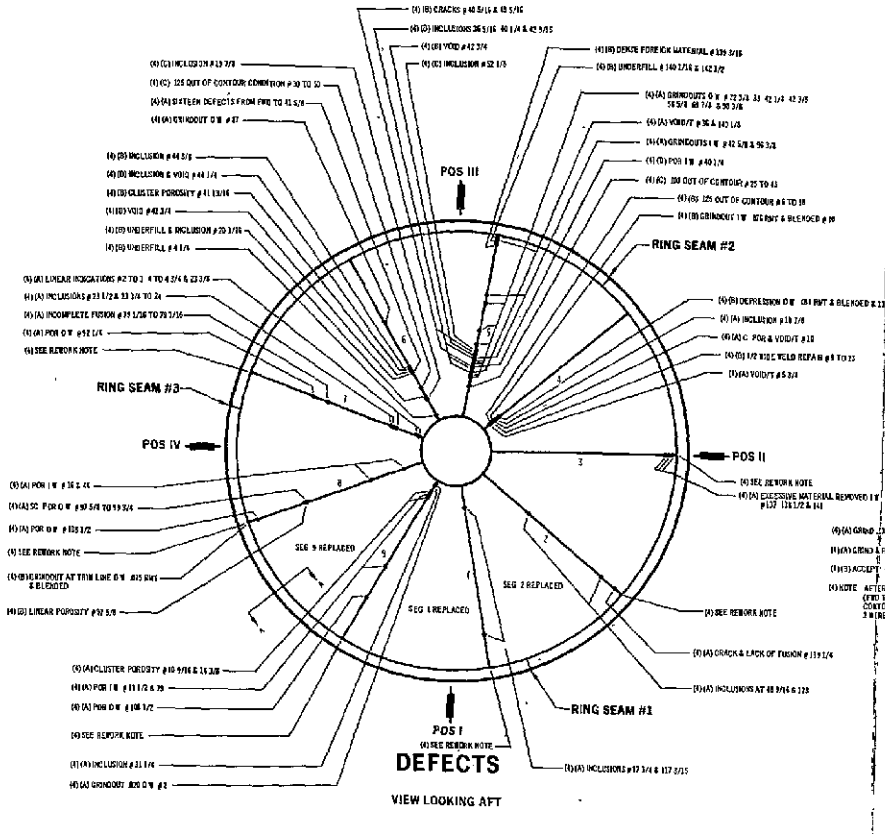
ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	HOW REWORKED	REWELDS
(6)	A836072 (SEAM 2)	6-1465	12	3	AUTO MIG	2
(8)	A835972 (SEAM 1)	6-1465	5	3	AUTO MIG	2
(8)	A835997 (SEAM 3)	6-1465	22	3	AUTO MIG	3
(8)	A836079 (SEAM 5)	6-1465	6	2	AUTO MIG	2
(9)	A842947 (SEAM 4)	7-465	2	2	N/A	0

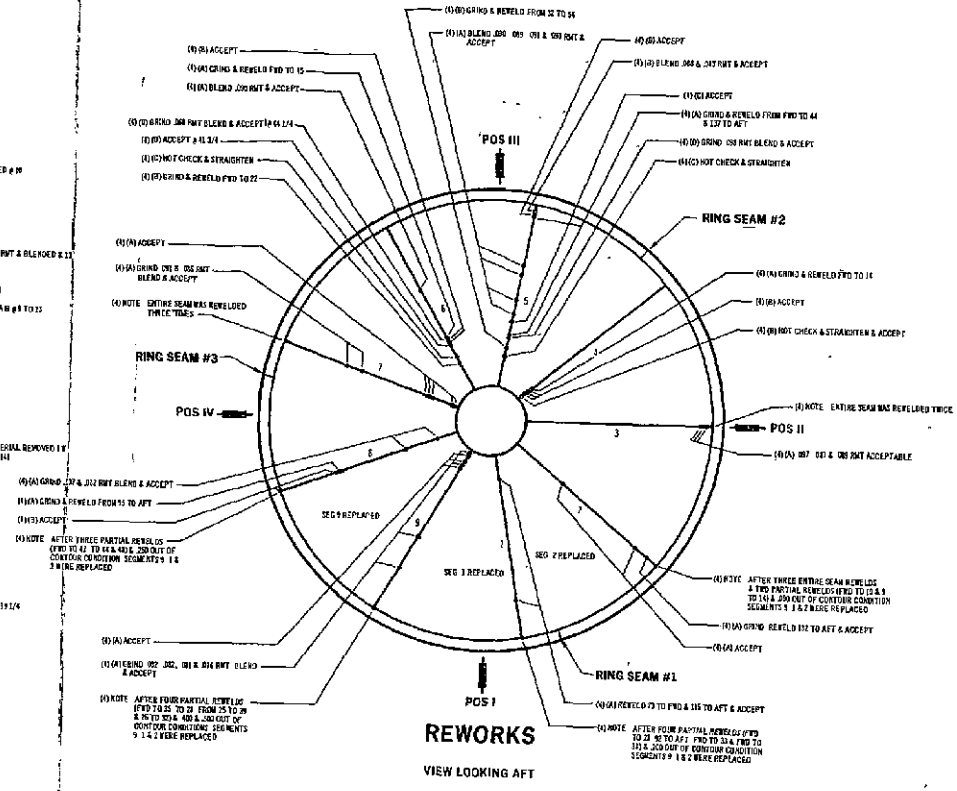
ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS

FOLDOUT FRAME 1

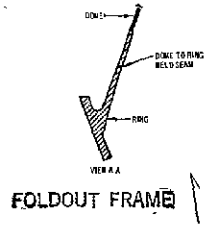
FOLDOUT FRAME 2

Chart 5. Forward Face Assembly





NOTE A – ALL SEAMS WERE ORIGINALLY WELDED
& SEAMS 3 & 1 & 2 WERE REPAIRED
USING "TIG"
B – SEGMENTS 3 1& 2 WERE REPLACED &
SEAMS 3 & 1 & 2 WERE REPAIRED USING
"MIG"



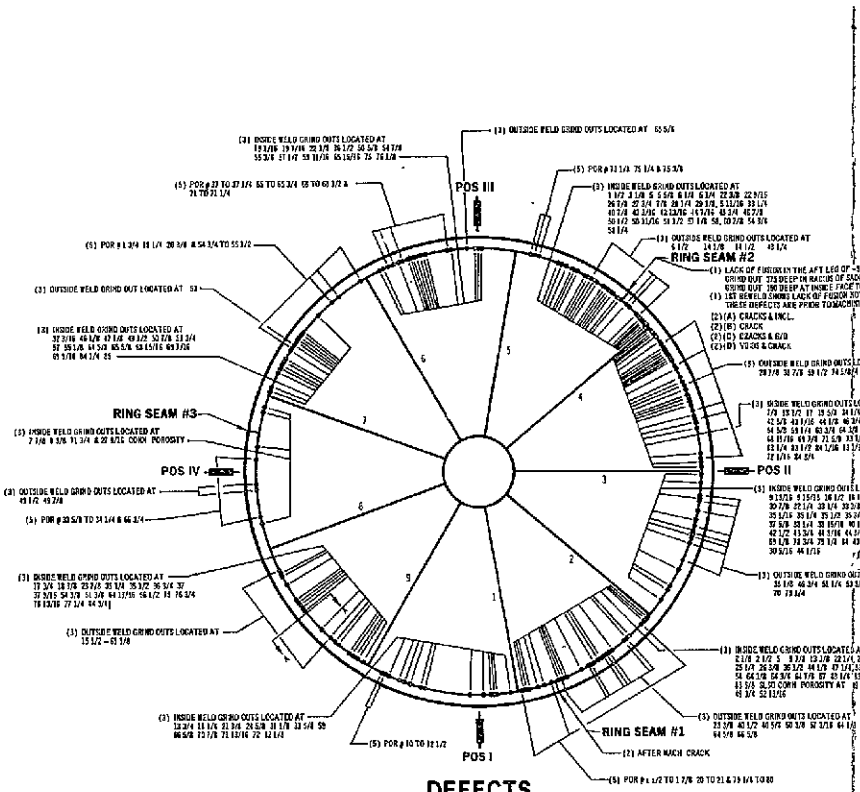
FOLDOUT FRAME 1

ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	HOW REWORKED	REWELDS
4	A136329 (SEAM 1)	5-4-65	SEE NOTE	2	SEE NOTE	2 PARTIAL
	(SEAM 2)	5-4-65	SEE NOTE	7	SEE NOTE	3 ENTIRE, 2 PARTIAL
	(SEAM 3)	5-4-65	SEE NOTE	2	SEE NOTE	2 ENTIRE
	(SEAM 4)	5-4-65	SEE NOTE	1	SEE NOTE	1 PARTIAL
	(SEAM 5)	5-4-65	SEE NOTE	10	SEE NOTE	3 PARTIAL
	(SEAM 6)	5-4-65	SEE NOTE	5	SEE NOTE	2 PARTIAL
	(SEAM 7)	5-4-65	SEE NOTE	5	SEE NOTE	3 ENTIRE
	(SEAM 8)	5-4-65	SEE NOTE	7	SEE NOTE	4 PARTIAL, 1 ENTIRE
	(SEAM 9)	5-4-65	SEE NOTE	9	SEE NOTE	0

ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS

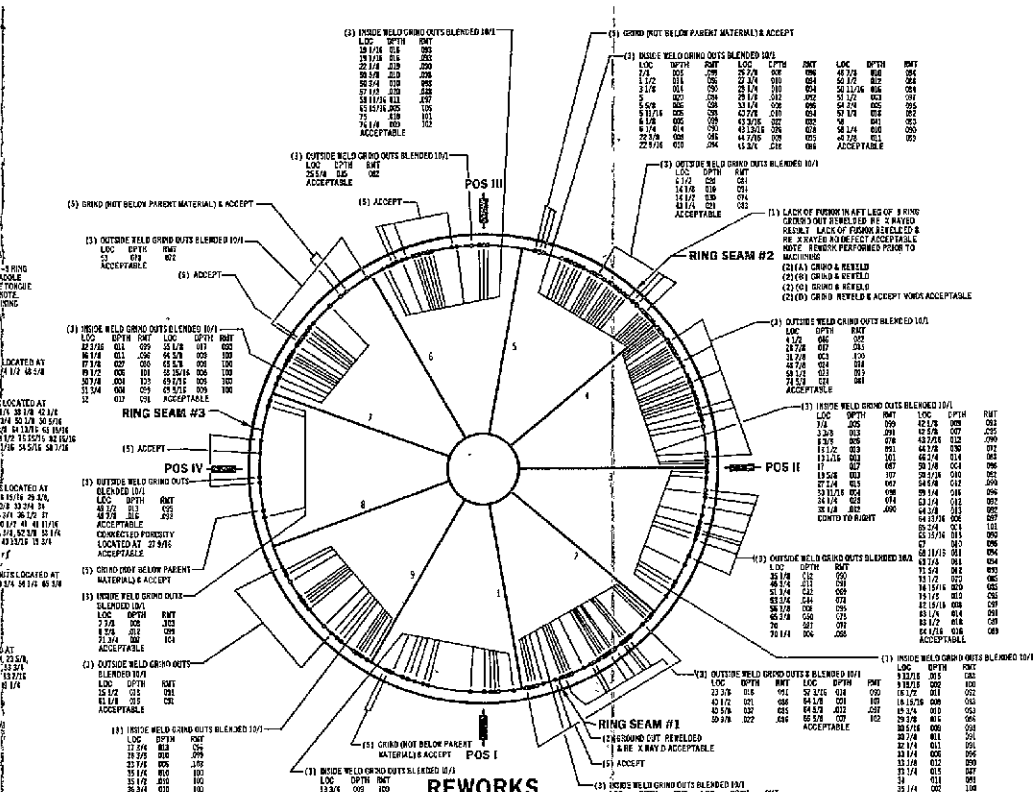
Chart 6. Aft Face Meridian Welds

FOLDOUT FRAME 2



DEFECTS

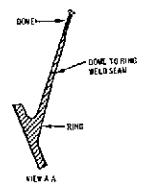
VIEW LOOKING AFT

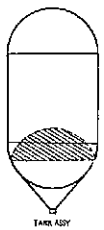


REWORKS

VIEW LOOKING AFT

FOLDOUT FRAME



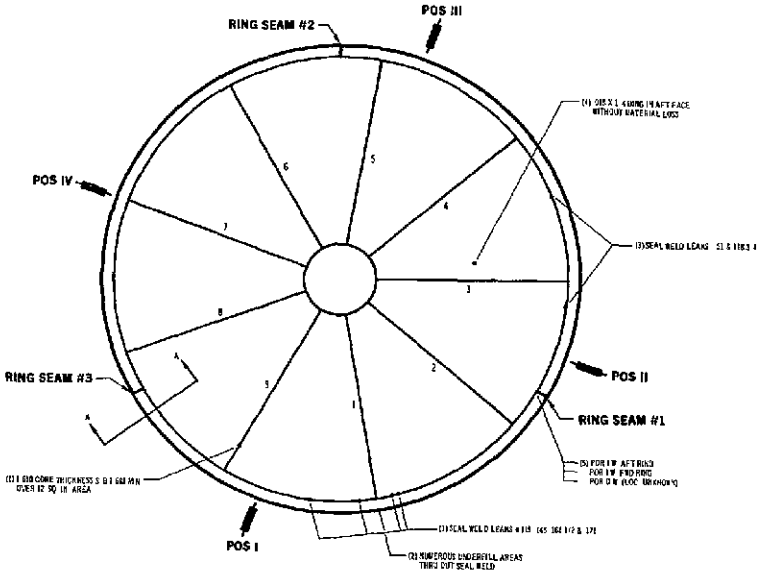


ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	HOW REWORKED	REWELDS
1	A136988	28 MAR 1965	2	2	HAND BUG	2
2	A136986	4 APR 1965	6	5	HAND BUG	5
3	A 136983	28 JUNE 1965	212	206	N/A	0
5	A135938	9-30-65	11	8	N/A	0

ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS

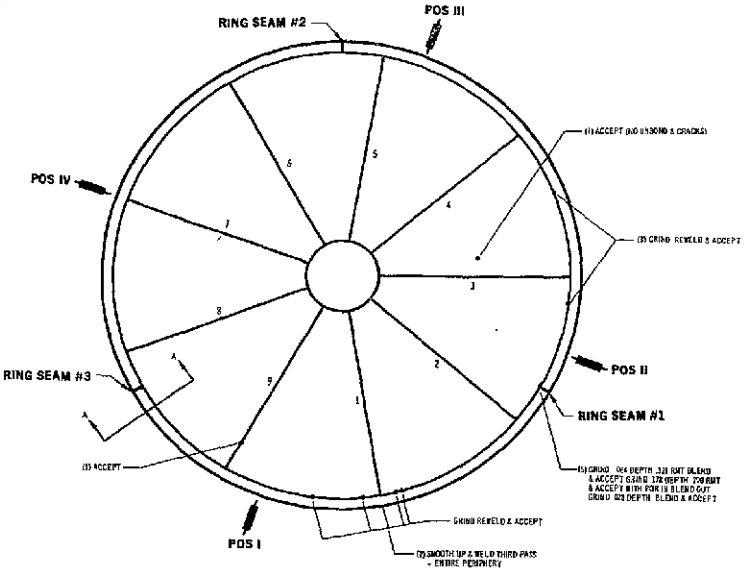
FOLDOUT FRAME 2

Chart 7. Aft Face Ring and Plate Welds



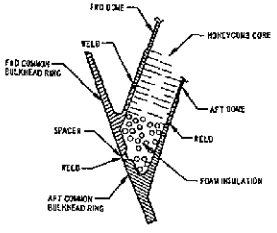
DEFECTS

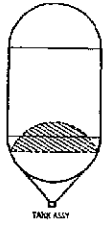
VIEW LOOKING AFT



REWORKS

VIEW LOOKING AFT





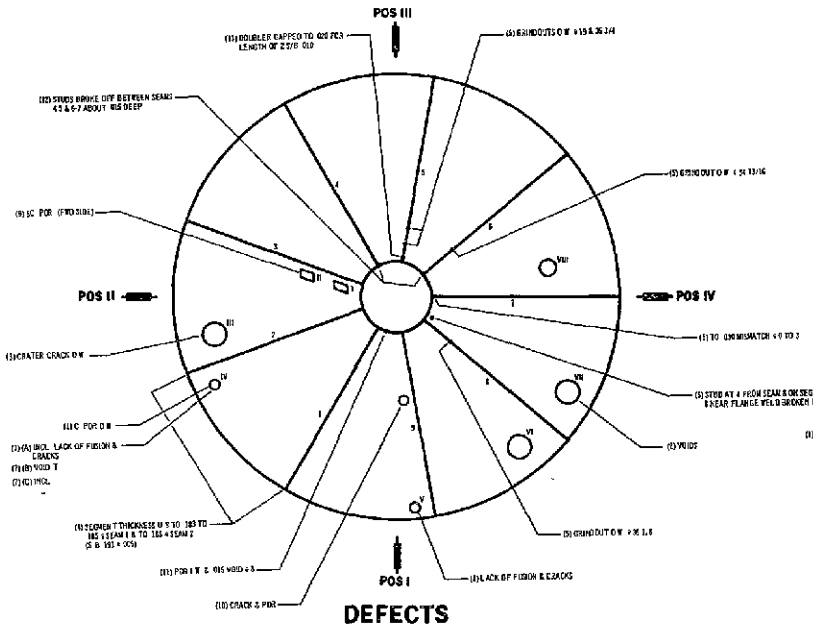
ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	HOW REWORKED	REWELDS
1	A155395	2-25-85	1	0	N A	0
2	A155575	5-19-85	1	1	AUTOMIG	1
3	A161915	5-24-85	6	6	MANUAL TIG	6
4	A155559	5-25-85	1	0	N A	0
5	A164811	6-28-85	3	3	N A	0

ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS

FOLDOUT FRAME 1

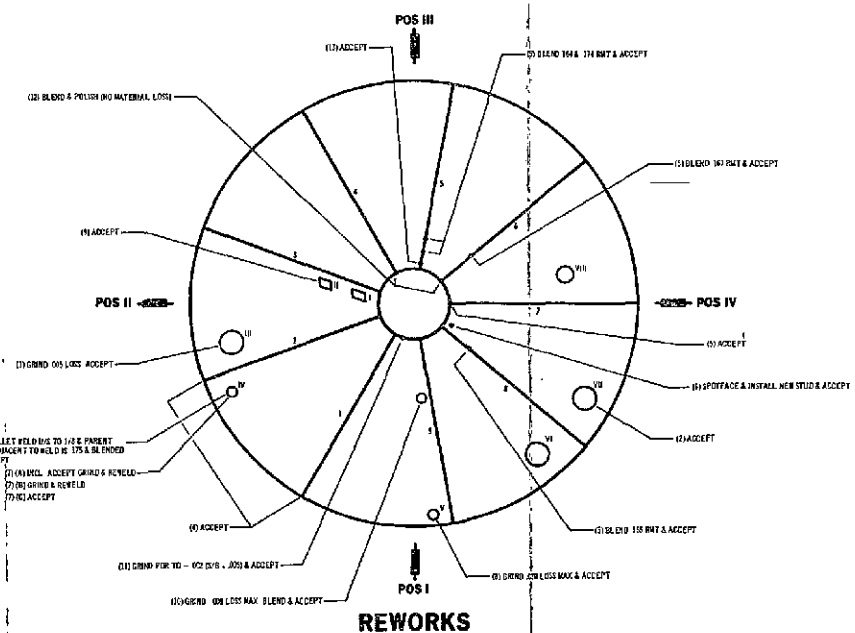
FOLDOUT FRAME 2

Chart 8. Common Bulkhead Assembly



DEFECTS

VIEW LOOKING FWD

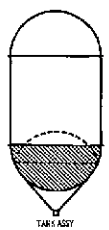


REWORKS

VIEW LOOKING FWD

LEGEND

I	BRACKET
II	BRACKET
III	FITTING ASSY (LOX FILL LINE)
IV	ELBOW ASSY (LH) FILL LINE)
V	ELBOW ASSY (LH) CHILL RETURN)
VI	FITTING ASSY (LH) FEED LINE)
VII	FLANGE (LH) CHILL PUMP)
VIII	FLANGE (LOX VENT)
IX	ELBOW ASSY (LOX CHILL RETURN)



ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	HOW REWORKED	REWELDS
(1)	A178138 F F	11-3-65	1	1	N A	0
(2)	A178851 A R	12-7-65	1	0	N/A	0
(3)	A178869 B B	12-9-65	1	1	N/A	0
(4)	A178841	12-13-65	0	0	N/A	0
(5)	A178850 MER	12-22-65	5	4	N/A	0
(6)	A181001 STUD	1-5-66	1	1	STUD WELDER	1
(7)	A181837 F F *	1-7-66	9	7	MANUAL TIG	2
(8)	A178883 SS *	1-7-66	4	4	N/A	0
(9)	A178902 M W *	1-7-66	1	0	N/A	0
(10)	A178905 B R *	1-7-66	3	3	N/A	0

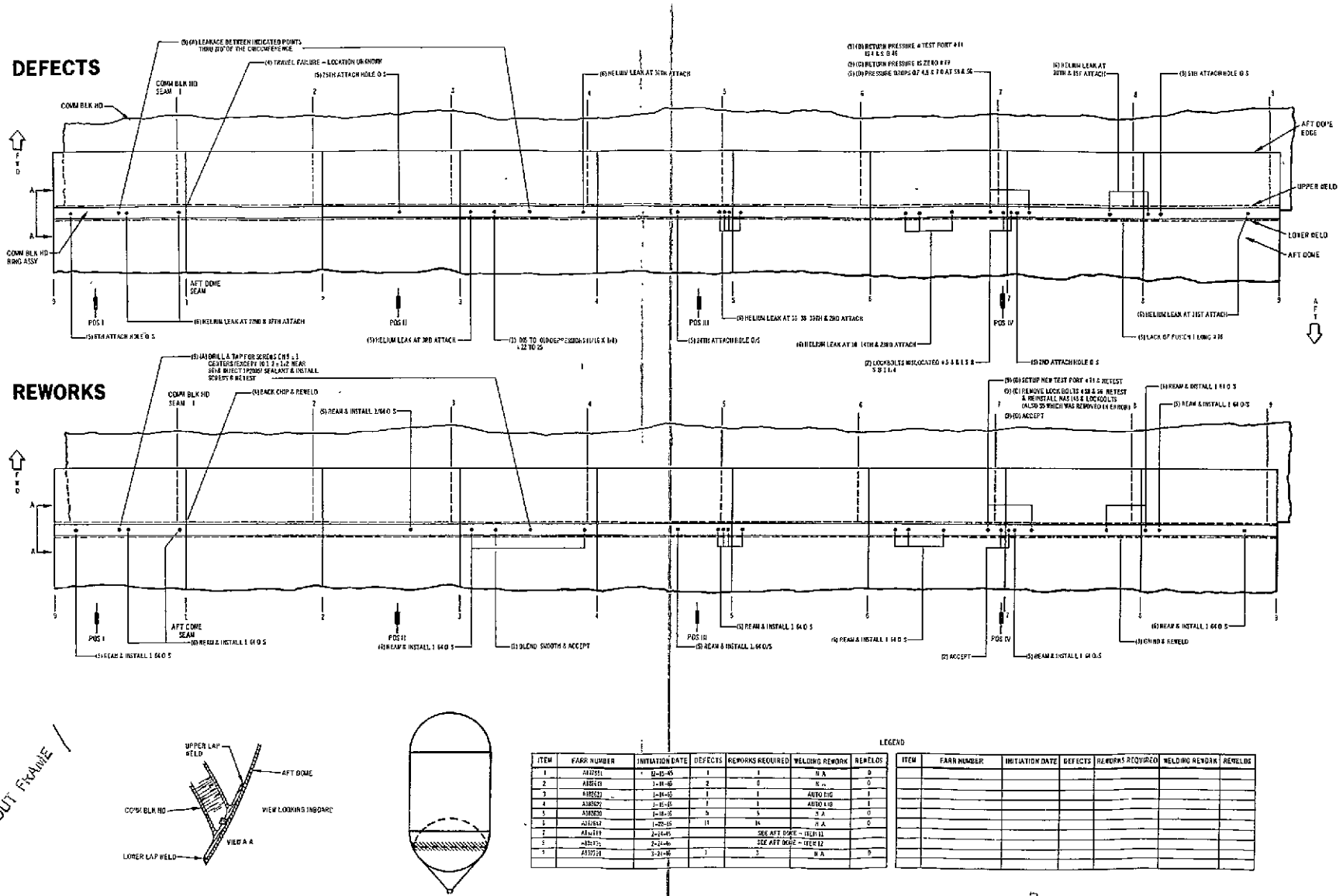
* HAND WELD

ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS
(11)	A178869	2-24-66	1	1	N A	0
(12)	A178430	2-24-66	2	2	N A	0
(13)	A178725	3-16-66	1	0	N/A	0

FOLDOUT FRAME 1

FOLDOUT FRAME 2

Chart 9. Aft Dome Assembly



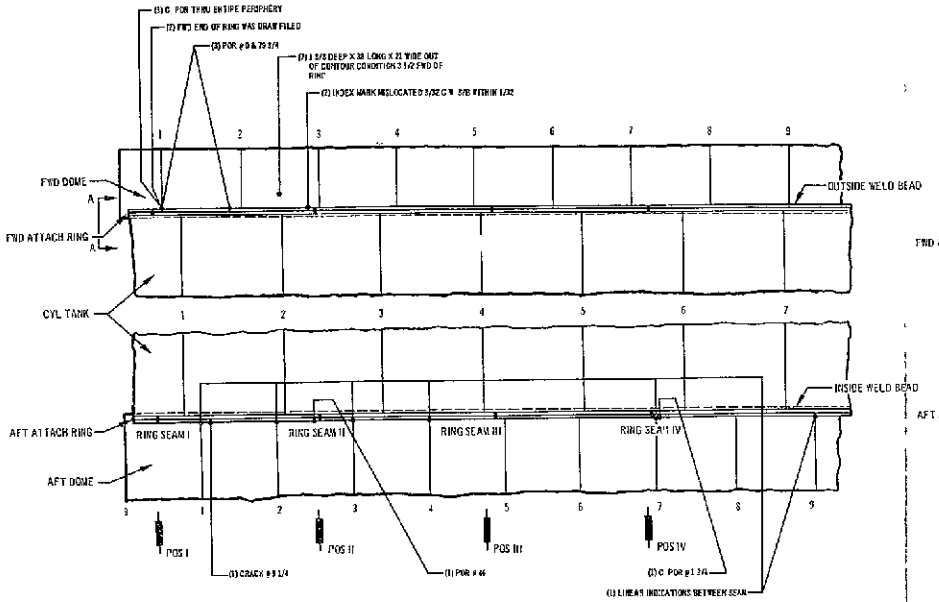
ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS
1	A887851	12-15-65	1	1	N A	0
2	A888418	1-11-66	2	0	N A	0
3	A889221	1-14-66	1	1	AUTO TIG	1
4	A889892	1-17-66	1	1	AUTO TIG	1
5	A890830	1-18-66	5	5	N A	0
6	A892847	1-25-66	14	14	N A	0
7	A894899	2-14-66			SEE AFT DOME - ITEM 11	
8	A895435	2-24-66			SEE AFT DOME - ITEM 12	
9	A897228	3-21-66	3	3	N A	0

ITEM	FARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS

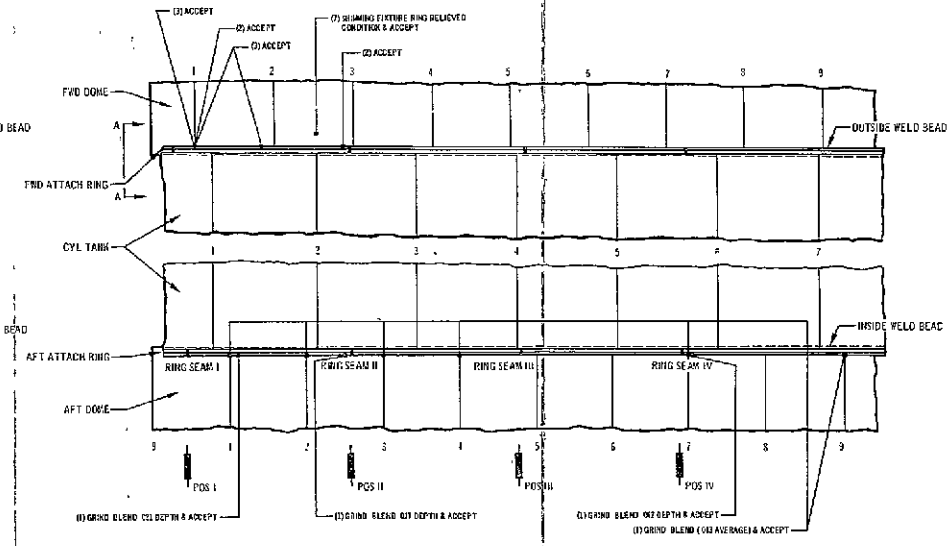
FOLDOUT FRAME

FOLDOUT FRAME 2

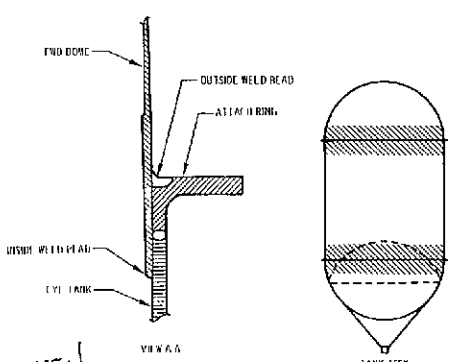
Chart 10. Common Bulkhead to Aft Dome Weld



DEFECTS



REWORKS



ITEM	PARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS
1	A188287	3-5-66	9	9	N/A	0
2	A192821	3-22-66	2	0	N/A	0
3	A189324 BEFORE MILLING	3-24-66	3	0	N/A	
4	A192825	3-28-66		SEE AFT DOME – ITEM 13		
5	A192882	3-28-66		SEE FWD DOME – ITEM 11		
6	A177371	4-3-66		SEE FWD DOME – ITEM 12, & CYL. TANK ITEM 14		
7	A192489	4-3-66	1	1	N/A	0
8	A192891	3-24-66		SEE COMMON BULKHEAD TO AFT DOME – ITEM 3		
9	A200538	3-30-66		SEE AFT COMMON BULKHEAD – ITEM 5		

ITEM	PARR NUMBER	INITIATION DATE	DEFECTS	REWORKS REQUIRED	WELDING REWORK	REWELDS

FOLDOUT FRAME 1

FOLDOUT FRAME 2

Chart 11. LOX Tank and Forward Dome to Cylinder Welds

FOLDOUT FRAME

FOLDOUT FRAME

TABLE I. PERMANENT NONCONFORMANCES AND FUNCTIONAL FAILURE AND REJECTION REPORTS DURING STAGE SYSTEM CHECKOUTS

Section 1. Sacramento Test Center Installation and Checkout

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A188069 12-8-66	The reseat pressure for fill module, P/N 1B57781-501, S/N 0019, was measured at 3125 to 3200 psig during five trials. The reseat pressure should have been 3500 psig per B/P 1B57781G.	The module was returned to the vendor for rework to specifications. The defective part S/N 0019 was replaced by S/N 0017.
A208936 12-6-66	On cable assembly, P/N 1B49398-509, the insulation was pulled back from connector P2, exposing the shield.	The cable assembly was scrapped. A new cable assembly was installed.
A218819 12-8-66	After bolting the stage to the dummy aft skirt: a. Two broken taps were found in bolt holes. b. Five broken bolts were found in holes.	a. The taps were removed, and bolts were installed per B/P. b. The broken bolts were removed and replaced per B/P. The rework was acceptable.
A218821 12-10-66	Several potted bus connectors failed the megger check specified in B/P 1B57771. The problem was discovered during testing per H&CO 1B64306.	After rework, all connectors except one were accepted for use. Connector, P/N 1A74036-1, was removed and replaced. The rework was acceptable.
A218822 12-12-66	Pipe assembly, P/N 1B67143-1, was 3/4 in. too long at the LOX vent valve end, causing it to rub against the LOX tank and the impingement curtain bracket.	The pipe assembly was scrapped and a new pipe assembly was installed.
A219001 12-7-66	Between forward skirt stringers 38 and 39, 4 ft. forward of the aft attach ring, there was a 1/4 in. by 1/2 in. by 1/8 in. dent in the skin.	The damaged area was spotfaced 3/4 in. in diameter. 7075-T6 40 gauge clad aluminum filler and doubler were fabricated and installed per Engineering instructions. The rework was acceptable.

TABLE I, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A219002 12-8-66	Receiving inspection of the stage revealed missing and damaged parts, parts not installed properly, and areas requiring paint touchup.	All problems were resolved satisfactorily.
A219007 12-13-66	Tube assembly, P/N 1B66837-1, rode hard on tube assembly, P/N 1B68838-1.	The 1B66837-1 was removed and replaced per B/P. The rework was acceptable.
A219008 12-17-66	Block assembly, P/N 1B64425-1, held tube assembly, P/N 1B64380-1, too high to align flanges with tube assembly, P/N 1B64384-1.	The block assembly was removed and trimmed as necessary per Engineering instructions. The rework was acceptable.
A219009 12-22-66	With the J-2 engine control bottle pressurized, and the helium control solenoid, P/N NAS-27273, S/N 342276, energized, there was a pressure bleed through the regulator assembly, P/N 556947, S/N 4080312, that would have depleted bottle pressure in 5 minutes.	The solenoid valves, S/N's 342271 and 342276, were replaced by S/N's 328179 and 328187, which were acceptable.
A219013 1-3-67	Gauge, P/N 1B55647-1, on hydraulic system air tank assembly, P/N 1B55408-503, had broken glass. The problem was noted during prefiring surveillance inspection.	The gauge was removed and replaced per B/P. The rework was acceptable.
A219014 1-11-67	EBW firing unit No. 1, P/N 40M39515-119, S/N 391, was charged to 4.63 vdc, rather than 4.2 ± 0.3 vdc per H&CO 1B59514. Card assembly, P/N 1B59981-1, S/N 1210B, located in DP1-B0 multiplexer 404A61A201, P/N 1B62513-513, was found to be at fault.	The PC card was removed and replaced. The rework was acceptable.

TABLE I, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A219017 1-19-67	There was intermittent talkback from the LOX and LH_2 chilldown shutoff valves, P/N's 1A49965-521, S/N 0302, and 1A49965-519, S/N 0104, respectively.	The valves were removed and replaced. The rework was acceptable.
A219018 1-19-67	There was intermittent talkback from LOX chilldown valve, P/N 1A49965-521, S/N 0302, during static firing.	The defective valve was returned to the vendor for rework to B/P and specifications. It was configurated to a -525. However, S/N 0301 was installed on the stage.
A219019 1-19-67	There was intermittent talkback from LH_2 chilldown valve, P/N 1A49965-519, S/N 0104, during static firing.	The defective valve was returned to the vendor for rework to B/P and specifications. It was configurated to a -523. However, S/N 0509 was installed on the stage.
A219023 1-26-67	Three scratches were found on the forward dome as follows: a. One 3 in. by 0.001 in., located 3 in. left of seam 3 and 49 in. down from the tank door. b. One 5/8 in. by 0.001 in., located 2 1/2 in. from the end of the above scratch. c. One 1 3/4 in. by 0.001 in. just below the above scratches.	a, b, and c. Acceptable to Engineering for use.

TABLE I, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A219051 12-13-66	Connector 404A61A204, P/N 1B57771-509, failed megger check per B/P 1B57771.	The defective connector was removed and a new connector was installed.
A219052 12-13-66	Connector 411A99A10-A23, P/N 1B57771-515, failed megger check per B/P 1B57771.	The defective connector was removed and a new connector was installed.
A219053 12-13-66	Connector 407A4A17, P/N 1B57771-519, failed megger check per B/P 1B57771.	The defective connector was removed and a new connector was installed.
A219054 12-13-66	Connector 404A4A17, P/N 1B57771-529, failed megger check per B/P 1B57771.	The defective connector was removed and a new connector was installed.
A219056 12-14-66	LH_2 chilldown pump, P/N 1A49421-503, S/N 143, operated dry for an undetermined period of time.	The pump was removed and replaced per B/P. The rework was acceptable.
A219062 12-17-66	R-3 potentiometer 411A92A6, P/N 1A59358-527, S/N 012, would not adjust per H&CO 1B63373.	A mislocated wire was found to be at fault. It was relocated, and the result was acceptable.
A219063 12-19-66	Pressure transducer 410MT600-D054, P/N 1B40242-523, S/N 523-19, read 105 psia at ambient.	The transducer was removed and replaced per B/P. The rework was acceptable.
A219064 12-19-66	Pressure transducer 410MT600-D054, P/N 1B40242-523, S/N 523-19, read 105 psia at ambient.	The transducer was returned to the vendor for rework to specifications. Transducer S/N 523-20, was installed and accepted.
A219066 12-19-66	The shells and mounting points on two vibration isolators, P/N B22-BC-0.5, were damaged beyond use.	The isolators were scrapped. New isolators were installed and accepted.

TABLE I, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A219067 12-20-66	There was a 2 inch scratch in the common bulkhead, 24 in. from the vee and 18 in. from seam 8.	Acceptable for use.
A219068 12-20-66	On pressure transducer 410MT614-D0178, P/N 1B43320-601, S/N 14-1C, the serial number was not legible.	**The serial number was inscribe in the appropriate block. The rework was acceptable.**
A219069 12-20-66	LH_2 chilldown pump, P/N 1A49421-503, S/N 143, was suspected of dry operation for an undetermined period of time.	The pump was returned to the vendor for rework per Engineering instructions. The rework was acceptable.
A219070 12-21-66	The rubber insert on plug 404W208P50, P/N S0286E-18-32S, was punctured at pin B.	The connector was removed and replaced per B/P. The rework was acceptable.
A219071 12-21-66	LH_2 inlet pressure transducer 403MT708-D104, P/N 1B40242-545, S/N 545-8, had an open circuit.	The transducer was removed and replaced. The rework was acceptable.
A219072 12-22-66	Bus connector, P/N 1A74063-1.1, S/N 0248, failed megger check. Should have been minimum resistance of 5000 megohms showed 500 megohms.	The connector was retested per B/P 1A74923 D, and was found to be acceptable for use as the defect could not be verified.
A219073 12-22-66	Bus connector 404A61A242J1, P/N 1A74063-1.1, S/N 00162, failed megger check. B/P resistance of 5000 megohms was actually 40 megohms.	The connector was retested per B/P 1A74923D, and accepted for use, as the B/P requirement was 5 megohms minimum. The unit was rejected in error, as the 5000 megohms limit did not apply to this part number.

TABLE I, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A229702 12-22-66	Forward battery simulator No. 2 had a varying output. The range of the output was from 2.5 to 5.123 vdc. The required output at ambient conditions was 3.5 ± 0.5 vdc per H&CO 1B59500.	The temperature telemetry module, P/N MA29A-2, was removed and replaced per B/P, correcting the condition.
A229703 12-22-66	Forward battery simulator No. 2 indicated a varying output of 2.5 to 5.123 vdc. The required output at ambient conditions was 3.5 ± 0.5 vdc per H&CO 1B59500.	The simulator was removed and replaced. The rework was acceptable.
A229706 12-28-66	On the J-2 engine, transducer, P/N 703682-31, measurement D57, had an out-of-tolerance high RACS output.	The transducer was removed and replaced following static firing. The rework was acceptable.
A229707 12-28-66	During performance of the signal conditioning system setup, H&CO 1B63149, the adjustment of power supply 404A64A211 was not within 5.000 ± 0.005 vdc.	After retest and readjustment of pots, the power supply was accepted by Engineering for use.
A229712 12-28-66	Transducer installation per AO 1A81847N-A45 failed to comply with tensile peel requirements per DPS 32330.	The installation was removed and replaced per B/P. The rework was acceptable.
A229713 12-28-66	Automatic spark igniter probe, P/N 19-501750, in the J-2 engine, was improperly wired.	The probe was removed and replaced per B/P. The rework was acceptable.

TABLE I, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A229714 12-28-66	Automatic spark igniter probe, P/N 19-501750, S/N 725, was improperly wired.	The probe was returned to R/NAA for rework to specifications.
A229717 12-30-66	On pressure switch 403A75S1, P/N 7851847-535, S/N 105, pins A and B were open. They should have been closed per H&CO 1B59514D.	The switch was returned to the vendor for rework to specifications, and S/N 106 was installed.
A229722 1-10-67	Output from channel CP1B0-03-03, on time division multiplexer 404A61A200, P/N 1B62513-515, S/N 00001, was 0 vdc. Should have been 1.5 vdc.	Printed circuit card, P/N 1B59981-505, was found to be at fault. The card was removed and replaced. The rework was acceptable.
A229724 1-13-67	Internal leakage of 50 psi/hour was noted in the hydraulic accumulator, P/N 1B29319-519, S/N 00023, during static firing.	The accumulator was removed and replaced. The rework was acceptable.
A229802 1-17-67	The ambient reading from transducer 4013MTT18-C1-401, P/N NA5-27323T3, S/N 1066, was 1879.188°F, during static firing. Output should have been 50 ± 0.72°F.	The transducer was returned to R/NAA for rework to specifications. Another transducer was installed and accepted.
A229803 1-18-67	During static acceptance firing, the main oxidizer valve position indicator, P/N 405817, S/N 8290075, read less than zero (full closed) at engine start, and was intermittent during mainstage burn.	The indicator was returned to R/NAA for rework to specifications.

TABLE I, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A229804 1-19-67	On submultiplexer card 404A61A200, P/N 1B59981-505, pin R had no output with power applied from the PUEA.	The unit was retested per B/P 1B59981, and was found to be acceptable for use.
A229806 1-19-67	On the LOX tank ullage pressure switch, at transducer 403MT737, P/N 7851847-533, S/N 107, the end with the connector attached was blown off the transducer. The defect was found while testing per H&CO 1B70413.	The switch was removed and replaced per B/P. The rework was acceptable.
A229807 1-26-67	Oxidizer pump discharge pressure transducer measurement D009, located at 4013MTP1, P/N NA5-27412T20T, had out-of-tolerance high and low RACS readings.	The transducer was removed and replaced. The rework was acceptable.
A229808 1-20-67	There were parts of two overhead lighting fixtures at the forward dome to forward skirt junction. Also, broken glass and other debris were found between forward dome seams 4, 5, and 6. The defects were discovered when inspecting for blast damage from the Beta III test stand.	The debris was cleaned up, and the areas were inspected for further damage. The cleaned up area was accepted for use.
A229810 1-23-67	On printed circuit card, P/N 1B59981-1, S/N 1210B, pin G had output of 4.62 vdc, exceeding the 4.2 $\pm$ 0.3 vdc tolerance.	The unit was retested per B/P 1B59981, and was found to be acceptable for use.
A229811 1-23-67	There were two dents in the LH_2 recirculation duct, P/N 1A49966-501, S/N 012, just outside the aft skirt. The dents measured 1/4 in. by 1/16 in. and 1/2 in. by 1/8 in.	After vacuum readings on the ducts were found to be 50 microns, the part was accepted for use.

TABLE I, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A229816 1-26-67	Sixteen studs, P/N 1B29309-1, holding disconnect, P/N 1A48848-505, to the forward skirt were loose.	The studs were torqued per B/P 1A39322. The rework was acceptable.
A229845 3-28-67	The following defects were noted during the post-checkout shakedown inspection: a. Non-propulsive vent elbow, P/N 1A87755-501, had a gap at the point of the weld. b. On the same elbow, there was evidence of corrosion at the stage attach point.	a. Acceptable to Engineering. b. The corrosion was removed with a wire brush. The rework was acceptable.
A229867 1-31-67	Contamination was suspected at flex ducts, P/N 1B70852, because: a. The B-nut connections to adapters, P/N 1B70624-1, were hand tight only. b. Caps, P/N AN9294C, on adapters, P/N 1B70624, were not secure. c. Threads were galled on the B-nut connections, and metal particles were present.	a, b, c. The fittings were disconnected and cleaned; then reconnected and tightened per B/P. Tamper seals were added. The rework was acceptable.
A229868 2-1-67	LH_2 directional control vent valve, P/N 1A49988-1, S/N 0022, had approximately 2 in. of gate seal missing.	The valve was removed and replaced, and the new valve was leak checked per B/P 1B70018. The rework was acceptable.
A229871 2-3-67	Contamination was suspected at the aft umbilical quick disconnects and the LOX tank. Contamination was likely in those areas because the disconnects were not wrapped properly, and because the LOX tank desiccant flex hose was loose at the LOX vent valve.	The areas were cleaned up. The umbilicals were then connected, and the flex hose was tightened and tamper seals were installed. The rework was acceptable.

TABLE I, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A234713 2-15-67	Engine pump purge regulator transducer 403MT600-D50, P/N 1B43320-511, S/N 19-16, read 49.1 psia at ambient.	The transducer was removed and replaced. The rework was acceptable.
A234714 2-16-67	LOX tank pressure control module, P/N 1B42290-503, S/N 0021, operated at 340 psia during static firing. It should have operated at 400 ± 25 psia.	The module was removed and replaced per B/P. The rework was acceptable.
A241901 2-14-67	a. A bubbling leak was noted at the B-nut on the T fitting, P/N 1B64131-1 at the connection point to tube assembly, P/N 1B64135-1. The leak remained after the connection was torqued to 1400 in. lbs. b. A fuzz leak was noted at the B-nut on tube assembly, P/N 1B58824-1, at the connection to the fill and drain control module. The connection was retorqued twice.	a. Crush washer, P/N MC 185C16A was installed. b. Crush washer, P/N MC 185C4A was installed. The rework was acceptable.
A241903 2-22-67	The chilldown actuation control module, 404A43, P/N 1A49982-517, S/N 122, leaked past the vent port seat with the valve in the open position.	The valve was removed and replaced per B/P. The rework was acceptable.
A241906 2-22-67	At thrust structure stringer 19, there were small dents in four shock mount isolators, P/N B21-BC-0.5.	Acceptable to Engineering for use.

TABLE I, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A241910 2-24-67	The high output pressure hose would not hook up properly to the accumulator GN_2 fill valve, P/N 1B31295-1, S/N 80, because the threaded area of the fill valve inlet was too short.	The fill valve was removed and replaced. The rework was acceptable.
A241916 3-1-67	a. The LOX vent and relief valve, P/N 1A48312-503, S/N 0024, leaked at the combined rate of 55 scim. b. Engine pump purge control module, P/N 1A58347-505, S/N 030, leaked at 0.3 scim. c. LOX tank relief valve, P/N 1A49590-513, S/N 518, leaked at 66.5 scim. d. Cold helium sphere, P/N 1A48858-1, S/N 1094, had a fuzz leak past the gasket at the sphere mounting interface.	a. The valve was replaced by a -505 configuration part. b. Acceptable to Engineering for use. c. The valve was replaced with a -515 configuration part per WRO 3314. d. All clamp bolts were checked for torque. The rework was acceptable.
A241920 3-1-67	There was a flat spot at the 90° bend, 4 in. from the end of tube assembly, P/N 1B67277-1.	The tube assembly was scrapped. A new tube assembly was installed and accepted.
A241923 3-20-67	There was excessive hydraulic fluid leakage at the shaft seal on hydraulic pitch actuator 403A71, P/N 1A66248-011A, S/N 47.	The area was cleaned. After leak checks and other tests were performed per Engineering instructions and H&CO 1B41004A, the actuator was accepted for use.

TABLE I, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A241924 3-21-67	On wire assembly 411A99A10W1, P/N 1B54269-1, S/N 00004, wire P119H20 was burned and damaged. Bare wire was exposed, and there was evidence that the wire had shorted to the structure.	The wire was removed and replaced. Damaged adjacent wires were wrapped with teflon tape per DPS 54010. The wire bundle was reclamped. The rework was acceptable.
A241925 3-21-67	The threads were stripped on standoff 404A2, P/N 1B31244-531, with the result that cables, P/N's 1B59468-1, 1B33327-1, and 1B59467-1, could not be secured to it with clamps.	The standoff was repaired per B/P 1B53312. The rework was acceptable.
A245490 5-16-67	Receptacle 404W15J1 on the aft umbilical had a broken key.	Acceptable to Engineering for use.
A245511 3-9-67	The digital events recorder fuel depletion sensor 1 wet cycled for 26 minutes after the first liquid indication.	The condition was temporarily acceptable, but was to be resubmitted after the next fuel loading operation.
A245513 3-20-67	a. Wire 411WP5 and 410A1J8 numbers Q9100 and Q9101, had two pieces of teflon tubing incorrectly installed and loose.	a. Acceptable to Engineering for use.
	b. There were several points of damaged insulation, exposing the shield, on cable 410MT601, P/N 1B40242-55.	b. and c. The defective cables were removed and replaced. The rework was acceptable.
	c. The insulation was damaged, exposing the shield, below the lower left hand corner of support panel on cable 410MT600, P/N 1B40242-67.	

TABLE I, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A245515 3-21-67	During the all systems test, H&CO 1B65533, measurement M069 exhibited 3 per cent noise fluctuations when the LOX and LH_2 chilldown inverters were in operation. The maximum allowable fluctuation due to EMI was 3 per cent.	Acceptable to Engineering for use.
A251479 5-12-67	Cable assembly, P/N 1B53574-501, going to transducer 403MT750C-D218, had broken insulation, exposing the shield, 1.5 feet from the transducer end.	The broken insulation was repaired with teflon tape per DPS 54010. The rework was acceptable.
A251517 5-18-67	Part of the key broke off receptacle 404W15J1, in addition to that reported on FARR A245490. The additional broken piece measured 3/16 in. in length.	The edges of the broken key were deburred and was accepted for use.
A261730 11-8-67	During the propulsion leak checks, the LOX propulsion valve, P/N 1B59010-503, S/N 117, leaked at the closing port adapter weld.	The adapter, P/N DEL-10361MC, was removed and replaced, and the valve assembly releak checked during applicable 1B71909 procedures.

TABLE I (Continued)

Section 2. Space Systems Center, Vehicle Checkout Laboratory

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A216726 8-19-66	The rubber insert was damaged between pins G and H in plug A62W200-P16 of wire harness, P/N 1B58192-1, S/N 00004.	Acceptable to Engineering for use.
A216727 8-19-66	There was a damaged rubber insert at pin B, plug P29, P/N S0-286E12-10S, on wire 404W7 of wire harness, P/N 1B58196-1.	Acceptable to Engineering for use.
A216728 8-31-66	There was no continuity between pins B and E of plug P45, wire 404W208, on LOX tank probe, P/N 1B41769-401.	The probe was removed and replaced.
A216729 8-31-66	There was no continuity between pins 2 and 3 on plug J4, wire harness 403A200, P/N 1B58136.	The plug was disassembled, and no malfunction was found. The plug was reassembled and continuity was established.
A216730 9-20-66	Remote analog submultiplexer, P/N 1B54062-503, S/N 018, failed intermittently to sync during DDAS testing.	The unit was retested per B/P 1B54063, and was found acceptable for use.
A216731 9-22-66	There was a leak in manifold assembly, P/N 1A68668-503, at the B-nut to cold helium bottle No. 4 in the main tunnel.	A crush washer was installed and the B-nut was retorqued. The rework was acceptable.
A216732 9-26-66	The LH_2 prevalve leaked at the B-nut of pipe assembly, P/N 1B58811-1.	A Voi-Shan seal, P/N S0254A4, was installed. The rework was acceptable.

TABLE I, Section 2 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A216733 9-27-66	There was a leak at the B-nut flare on pipe assembly, P/N 1B52566-1, at the customer connect panel.	A crush washer was installed per DPS 10002. The rework was acceptable.
A216734 9-28-66	Transducer, P/N 1B40242-533, S/N 533-12, was intermittent.	After retest failed to reproduce the defect, the unit was accepted for use.

TABLE I (Continued)

Section 3. Assembly and Systems Installation

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A159320 9-4-66	Inspection showed that at forward skirt stringer 61, 30 in. aft of the forward face, pipe assembly, P/N 1B58657-517C, had two MC124D6 coupling nuts installed. Coupling nuts should be S0864-6 per B/P 1B54657.	MC124D6 coupling nuts acceptable to Engineering.
A196257 6-16-66	In thermoconditioning panel, P/N 1A98145-515, S/N 2008, one hole was mislocated, an excess hole was drilled, and three B/P holes were omitted.	The excess nut plate was removed, and all holes were plugged. The panel was completed per B/P.
A203681 7-15-66	On the aft skirt: a. Duct assembly, P/N 1A78053-1, had one excess No. 40 hole in the mounting bracket, and six 0.190/0.195 in. holes which were oversize from 0.200 to 0.260 in. b. A No. 40 hole in the bracket which was called out per B/P was misaligned with the excess hole.	a. The excess hole was plugged double flush with MS 20427M3 rivet material, and the oversize holes were accepted for use. b. The mislocated hole was plugged double flush with AD3 rivet material. The bracket was trimmed to allow installation of B/P attachments. All rework was acceptable.
A203764 7-19-66	Per QEC 728, gap "E" datum plane had out-of-tolerance gaps at eleven locations.	Acceptable to Engineering for use.
A203767 7-21-66	Between thrust structure stringers 18 and 25A, twelve extra holes were drilled through the LOX tank attach angles.	Bolts, P/N 10264-9A, nuts, P/N NS102889-048, and washers, P/N S0148A050-026, were installed in the excess holes. The rework was acceptable.

TABLE I, Section 3 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A216703 9-1-66	On wire harness 404W208, P/N 1B58131-1, the insulation was damaged on shielded twisted pairs D1673A22 and D1674A22, and D1184A22 and D1182A22.	The damaged wires were repaired with teflon tape per DPS 1.357-15. The rework was acceptable.
A216708 11-7-66	Pipe assembly, P/N 1B58657-507, was kinked 1/4 in. behind the B-nut that connected to pipe assembly, P/N 1B38424-503.	The kinked pipe assembly was removed and replaced per B/P. The rework was acceptable.
A216709 11-9-66	There was a 3/8 in. x 1/4 in. x 0.030 in. ding in non-propulsive vent duct, P/N 1A87436-501.	Acceptable to Engineering for use.
A216711 11-14-66	Cable assembly on transducer 410MT601, P/N 1B40242-55, S/N 509-18, had the insulation torn in two places, exposing the shield.	The damaged areas were tension spiral wrapped with teflon tape per DPS 54010. The rework was acceptable.
A216712 11-14-66	a. At the forward end of the aft skirt, numerous stringer caps, P/N 1B42355, were installed in a preloaded condition. b. An extreme preloaded condition at stringer 78 caused the cap to crack.	a. Acceptable to Engineering for for use. b. The cap at stringer 78 was removed and replaced. The rework was acceptable.
A216713 11-30-66	The elastometer was debonded from the frame of vibration isolator, P/N 90582-1.	The isolator was removed and replaced. The rework was acceptable.
A216826 7-26-66	The phenolic base was broken on the Al grommet on wire harness 403W33, P/N 1B57017-1.	Acceptable to Engineering for use.
A216828 7-26-66	At aft skirt stringers 93 and 94, station 280, the shell of receptacle 404A41-J2 on LH_2 chilldown pump, P/N 1A49421-503, had a flat spot adjacent to pin 4.	The receptacle was reformed to the desired contour. The rework was acceptable.

TABLE I, Section 3 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A216830 7-27-66	a. Per QEC 960, the surface of panel, P/N 1B38125-501, was 0.070 in. out of parallel. Maximum allowable was 0.040 in. out of parallel. b. On the same panel, the location of the attachment holes was 0.120 in. from perpendicular. Maximum allowable was 0.100 in. per QEC 960.	a. Tapered shims were fabricated and installed between the panel and angles, P/N's 1B37637-5, -13, -17, and -21. b. The panel was removed and rotated clockwise to B/P requirements. Both reworks corrected the problems satisfactorily.
A216833 7-29-66	Narmco adhesive residue was found inside the LH_2 chilldown return elbow at aft skirt stringers 6 and 7, station 235.	The adhesive was removed with a plastic scraper and methylene chloride. The rework was acceptable.
A217001 8-9-66	Tap fittings, P/N's 1B29959-1 and 1B29958-1, were mislocated 4 1/2 in. to 6 in. to the right of the aft dome weld seam adjacent to aft skirt stringer 26, station 240.	Pipe assembly, P/N 1B52526-1, which could not be installed due to the mislocated fittings, was redeveloped and installed per Engineering instructions. The rework was acceptable.
A217011 8-18-66	Four holes were mislocated 1/8 in. through segments, P/N's 1B65395-513 and -1, and LOX tank to structure attach angle, P/N 1B64563-511. Because of this, it was impossible to maintain proper edge distance on the installation of retainer, P/N 1B54098-567.	The retainer was cut where edge distance could not be maintained. It was then installed per Engineering instructions, and accepted for use.
A217013 3-19-66	Four holes were mislocated 1/8 in. through segments, P/N's 1B65395-505 and -507, and LOX tank to thrust structure attach angle, P/N 1B64563-507. Because of this, proper edge distance could not be maintained when retainer, P/N 1B54098-575, was installed.	The retainer was cut at the end where the edge distance was short. It was then installed, picking up B/P attachments. The rework was acceptable.

TABLE I, Section 3 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A217024 8-24-66	Retainer, P/N 1B54098-543, for the installation of the impingement curtain on the thrust structure at stringers 21A and 22A, was too short. As a consequence, retainer, P/N 1B54098-545, was rotated counterclockwise, creating a 2 3/4 in. gap between the -545 and -501 retainers.	Retainer, P/N 1B54098-545, was removed and replaced with a -501 which was trimmed to fit. The rework was acceptable.
A217192 9-20-66	a. Duct assembly, P/N 1A49320-501-001, S/N 32, had numerous scratches and dings in the outer wall, ranging from 0.001 in. to 0.005 in. in depth. b. Vacuum check per B/P A659-1A39322-1-PATP3CRT4 was not accomplished prior to installation.	a and b. Acceptable to Engineering for use.
A220116 8-18-66	There were excess holes noted in piping boots, P/N's 1B44621-503 and -505.	Patches were cut from boot material and bonded to the outside of the boots in the puncture areas. The rework was acceptable.

TABLE II. FAILURE AND REJECTION REPORTS, STRUCTURAL ASSEMBLIES

Section 1. Propellant Tank Assembly, P/N 1A39303-519

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A168956 10-20-65	There were mislocated "H" holes in doublers -33 and -35. Edge distance was 5/32 in., should have been 23/32 in.	Doublers were removed and replaced with blank doublers. Holes were located per existing holes in stage. Rework acceptable to Engineering.
A177071 4-3-66	Dye check of forward dome seam and fitting welds revealed. a. Star cracks in fitting R-R, segment 4. b. Star cracks in fitting C-C, segment 2. c. Greater than No. 3 porosity in seam 1.	All defects were ground out and accepted for use.
A177075 5-6-66	Inspection of the propellant tanks revealed that segments 3, 5, and 7 did not meet tensile bond requirements specified in DPS 23003.	Test of specimens was acceptable to Engineering. Segments were reworked to replace the liner in those areas per Engineering instructions. The rework was acceptable.
A188707 3-5-66	Dye check of the aft dome ring weld revealed transverse cracks, No. 3 porosity, transverse linear connected porosity, and dye indications, except between meridian seams 5 and 6, 6 and 7, and 8 and 9.	Defects were ground out, smoothed, and blended to a 10:1 ratio. The rework was acceptable.
A188724 3-14-66	Dye check of the forward dome to ring outside weld revealed a greater than No. 3 porosity in the areas of segment 1 and segment 2, and linear connected porosity throughout the weld.	Defects were acceptable to Engineering for use.

TABLE II, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A192821 3-12-66	a. The forward end of the cylindrical ring was draw filed to remove mill marks without Engineering authorization. b. The position 2 prick punch on the cylindrical ring was misaligned 3/32 in.	a and b. Acceptable to Engineering for use.
A192825 3-16-66	There was a 0.020 in. gap between doubler, P/N 1B59281-27, and the skin at aft dome seam 5.	Acceptable to Engineering for use.
A192982 3-13-66	Forward dome attach angles at seams 3, 5, 6, and 8 had damaged areas, double drilled holes, and skin wrinkles.	The damaged areas were blended and polished. All others were accepted for use.
A192987 3-20-66	The primed surface surrounding the LOX door jamb was discolored.	Acceptable to Engineering for use.
A192991 3-24-66	The common bulkhead joint could not be pressurized to 46 $\pm$ 2 psi per DPS 40014. The leakage was detected at the open blind bolt core holes.	The holes were filled with 1P20057 sealant. After several applications, the rework was accepted for use.
A193469 4-3-66	There was a 38 in. x 21 in. x 1 3/8 in. canned area in forward dome segment 3, 3 1/2 in. forward of the interface ring.	The fixture ring was shimmed to relieve existing preload, and the out-of-contour condition was accepted by Engineering for use.
A193472 4-12-66	While curing the adhesive bonding supports, P/N's 1B31138-1, 1B37414-1, 1B37888-529 and -521, 1B37889-531, and 1B37899-1 and -501, in the main tunnel area, vacuum was lost for 30 seconds.	All supports were removed and replaced per B/P.

TABLE II, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A193473 4-15-66	On the exterior of the LH_2 tank, supports, P/N's 1B31140-1, and 1B37899-1 and -501, were bonded onto unprimed skin.	Support, P/N 1B31140-1, was removed per DPS 32330 and replaced per B/P. The others were accepted for use.
A193474 4-15-66	On the exterior of forward dome seam 3, nine supports were bonded to unprimed skin.	Acceptable to Engineering for use.
A197726 4-15-66	On the exterior of aft dome seam 7, 120 in. outboard from the center, support, P/N 1B37889-529, had an adhesive plugged insert.	The support was removed per DPS 32330 and replaced per B/P. The rework was acceptable.
A197727 4-15-66	On the exterior surface of the main tunnel, at station 328, support, P/N 1B37889-531, was partially bonded onto an unprimed surface.	Acceptable to Engineering for use.
A197730 4-19-66	On the aft dome, 6 in. forward of the thrust structure attach angle, support, P/N 1B37762-1, was unbonded.	The support was removed and replaced with a new part per B/P. The rework was acceptable.
A197744 6-7-66	Along the exterior of forward dome weld seam 3, 85 in. to 120 in. outboard from the center hole, twelve nylafil supports were bonded to an unprimed surface.	One support, P/N 1B57158-3, was acceptable for use. All others were removed per DPS 32330 and replaced per B/P. The rework was acceptable.
A198126 5-12-66	At the aft and forward circumferential balsa weld seams, in the glass liner, temperature and vacuum recordings were not taken for 2 1/2 hours, and those temperatures recorded during the 24-hour cure were excessively high per DPS 23003.	After reviewing tensile test results, Engineering accepted the situation for use.

TABLE II, Section 1 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A198128 5-17-66	Aft dome segment 9 glass liner adhesive bond did not meet the tensile strength requirements of DPS 32003. The required bond strength to withstand an average pull of 150 psi was not met since on the average the bonds were broken at 64 psi.	Acceptable to Engineering for use.
A203703 7-13-66	a. There were scratches in five helium bottles in the LH_2 tank. b. There were scratches and a ding in the forward face segment 3 skin.	a and b. Acceptable to Engineering for use.
A209538 3-30-66	Dye penetrant inspection of the common bulkhead ring weld revealed No. 3 porosity in several locations throughout the weld.	The porosities were ground out and accepted.
A209939 6-13-66	On the LOX vent line installation, two strut assemblies, P/N 1A57514-511, were damaged at the lower end. The damaged flat area of the left strut had been filed without authorization.	The damaged areas were blended with No. 400 paper and brushed with alodine. The rework was acceptable.
A209941 6-13-66	The oxidizer vent duct, P/N 1A69044-1, S/N 021, was dinged in three locations.	The duct was removed and replaced per B/P.

TABLE II (Continued)

Section 2. Forward Dome Assembly, P/N 1A39304-509

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A182636 1-19-66	Inspection revealed an underfill condition in the flange to dome weld midway between seams 3 and 4.	Defect was ground out, smoothed and blended. Rework was acceptable to Engineering for use.
A182649 1-23-66	Inspection of segment 4 revealed two undersize areas in the fillet weld around the LH2 pressure fitting. Total defective area was 2 in.	Defective area was ground out and rewelded. The rework was acceptable.
A182650 1-23-66	Inspection of segment 8 revealed cuts and scratches on the exterior surface surrounding the AE-AE fitting.	Defects were blended out and touched up with alodine per DPS 9.45. Rework acceptable to Engineering for use.
A182660 1-22-66	X-ray 66-B12 of segment, S/N 00144, revealed incomplete weld penetration at the weld root, void, underfill, and cold shot (transverse) in the AE-AE chip to segment weld.	Defects were minor in nature and therefore were acceptable to Engineering for use.
A182662 1-25-66	X-ray 66-B12 of segment, S/N 00156, revealed suckback in the AH-AH flange to dome outside weld.	Suckback was smoothed and blended. Rework was acceptable to Engineering for use.
A182667 1-29-66	Dye check of segment, S/N 00143, revealed a crater crack in the outside weld of the FF fitting.	Defect removed by grindout and blend. Rework acceptable to Engineering for use.
A187003 1-24-66	Inspection of the segment 2 to AC-AC fitting weld revealed: a. Entire circumference of weld had lack of fusion, holes, and irregular bead.	a. Defective weld was ground out and auto-rewelded. b. Defects were chipped and ground out, and auto-rewelded locally.

TABLE II, Section 2 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A187003 (Cont.)	b. X-ray 66-B12 revealed a cavity in view 1, a void in view 2, and connected porosity in view 4.	c. Circumference of the weld was ground out to the set up line and rewelded.
	c. Grindout to setup line.	d. Canned areas were heated and recontoured.
	d. Canned condition two places in the segment.	e. Cracks were ground out and blended, and segment was subjected to eddy current test. Rework acceptable to Engineering for use.
	e. X-ray and dye check showed cracks at edge of weld.	
A187023 1-31-66	X-ray 66-B12 and dye check of the meridian welds revealed:	a. Seams 1, 2, 5, 6, 7, 8, and 9 required one reweld each before grindouts and blends were acceptable to Engineering. Seam 4 did not require a reweld.
	a. Seams 1, 2, 4, 5, 6, 7, 8, and 9, had fine scattered porosity, clusters and connected porosity, scattered porosity, linear porosity, inclusions, and underfill.	b. Mismatch and canned condition of seam 2 were alleviated during reweld. Rework acceptable to Engineering for use.
	b. Seam 2 also had a mismatch and a canned condition.	
A189317 2-11-66	Inspection of the forward dome with a pi tape revealed that the equatorial plane was 0.015 in. out of tolerance.	The out-of-tolerance condition was acceptable to Engineering for use.
A189332 2-16-66	Inspection of the forward dome flange weld revealed:	a. Canned area was heated and recontoured, eddy current checked, X-rayed, and dye checked. Rework acceptable to Engineering for use.
	a. A canned condition in segment 3 adjacent to flange weld area.	b. Underfill was ground, smoothed, and blended to a 10:1 ratio. Rework acceptable to Engineering for use.
	b. A grindout in meridian seam 8 at the junction of the flange weld caused underfill.	

TABLE II, Section 2 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A189332 (Cont.)	c. Scraper marks in flush areas of meridian welds adjacent to the inside flange weld.	c. Scraper marks were smoothed out. Rework acceptable to Engineering for use.
A189335 2-17-66	Dye check of the inside forward dome flange weld revealed: a. Weld overlap between seams 4 and 5. b. No. 3 porosity between seams 6 and 7, 8 and 9, and 9 and 1.	a. Weld overlap was scraped flush. The rework was acceptable to Engineering for use. b. Porosity was ground out, smoothed, and blended to a 10:1 ratio. The rework was acceptable to Engineering for use.
A189344 2-23-66	Inspection of forward dome segment 7 revealed: a. Two cracks in the outside surface, opposite bracket, P/N 1B42297-1, on inside surface of the segment. b. High area on outside surface, opposite bracket, P/N 1B42297-1.	a and b. The bracket was removed and segment 7 was reworked per SEO's 1A39304-013 and 1A39304-014. The rework was acceptable.
A189359 3-1-66	Inspection of the planes and radii of the forward dome revealed that the contour was out-of-tolerance at latitudes 60° and 82°, and the AH-AH pressure sensor fitting.	The out-of-tolerance condition was acceptable to Engineering for use.

TABLE II (Continued)

Section 3. Cylindrical Tank Assembly, P/N 1A39306-505

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A171525 10-30-65	X-ray 65-B131OW showed a linear porosity and a misplaced setup line in the outside weld of the bottle fittings on cylindrical tank segment, P/N 1A39306-405, S/N 13.	The noted conditions were acceptable to Engineering for use.
A171527 11-1-65	A dye check of the outside welds of the helium bottle fittings on cylindrical tank segment, P/N 1A39306-405, S/N 17, showed a crater crack at fitting 4, and a lack of fusion at fitting 2.	The defective areas were scraped and ground out, smoothed, etched, and dye checked. The rework was acceptable to Engineering for use.
A171538 11-3-65	A dye check of the support fitting welds on cylindrical tank segment, P/N 1A39306-405, S/N 14, showed No. 3 porosities and weld overlaps at fittings 1, 2, 3, and 4.	The defective areas were ground out to an acceptable condition.
A171594 12-7-65	X-ray 65-B155BM showed voids, scattered and linear porosities, and lack of fusion in the ring seam welds of the cylindrical tank aft ring, P/N 1B39306-23, S/N 8. Following reweld-ing operations, X-ray 65-B155R1 showed lack of fusion and porosities, and X-ray 65-B155R2 showed inclusions.	The defects were ground out and re-welded. After three rewelding opera-tions, X-ray 65-B155R3 was acceptable. The rework was acceptable to Engineer-ing for use.
A171992 11-4-65	Inspection of segment, S/N 00013, revealed that the No. 4 fitting was 0.012 in. out of round. Maximum allowable ovality was 0.010 in.	Out-of-tolerance ovality of the No. 4 fitting did not impair usage; therefore Engineering accepted the part for use.
A172135 11-11-65	Cylindrical tank segment, P/N 1A39306-405, S/N 112, had several gouges, 0.002 in. to 0.030 in. deep, in the forward eight clevis weld pads.	The edges of the gouges were smoothed without increasing the depth. The rework was acceptable for use.
A176994 1-3-66	Visual inspection and dye check revealed porosity greater than No. 3 in longitudinal seam 6 inside weld.	Defects were ground out, and the grindout was smoothed and blended to a 10:1 ratio. The rework was acceptable to Engineering.

TABLE II, Section 3 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A176996 1-3-66	A dye check and visual inspection of the cylindrical tank assembly, P/N 1A39306-505, S/N 2008, showed No. 3 porosity at two places in the outside weld of seam 5, after the areas were ground below the parent material.	X-ray 65-50 showed that seam 5 was acceptable. The defective areas were blended out to a 10:1 ratio, finished to a maximum 63 rms surface, and dye checked. The rework was acceptable to Engineering for use.
A177032 1-9-66	A visual inspection per DPS 14052 showed that the outer side of cylindrical tank segment 1, P/N 1A39306-27, S/N 19, had intermittent scratches adjacent to weld seam 1, along the entire length of the seam. The scratches ranged from flush to 0.002 in. deep.	The scratches were blended to a 10:1 ratio to the existing depth, and smoothed to a 63 rms surface finish. The rework was acceptable for use.
A177034 1-10-66	X-ray 66-50 showed a void with a tail in cylinder seam 2.	Defect was ground out, smoothed, and blended to a 10:1 ratio. Rework acceptable to Engineering for use.
A177035 1-10-66	X-ray 66-50 and dye check revealed No. 3 porosity condition in seam 7 inside weld.	Defects were ground out, smoothed, and blended to a 10:1 ratio. Rework acceptable to Engineering for use.
A177861 12-18-65	X-ray 65-B162BM showed a crack in seam 3 of the cylindrical tank forward ring, P/N 1A39306-35, S/N 8.	The crack was ground out and dye checked. The rework was acceptable to Engineering for use.
A184691 2-2-66	The inside weld was ground below the parent material out of B/P tolerance.	Excessive grindout was acceptable to Engineering for use after blending.
A184692 2-3-66	The grindout to remove linear dye check indications went below the parent material on the inside ring to tank weld.	Grindouts were blended per DPS 15101. Rework was acceptable to Engineering for use.

TABLE II, Section 3 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A184693 2-3-66	Angularity inspection revealed that an out-of-tolerance condition existed at forward ring seam 1 and aft ring seams 3, 5, 6, and 7.	The out-of-tolerance conditions were acceptable to Engineering for use.
A188497 2-26-66	The centroid of the tank exceeded B/P tolerance.	The tank was shimmed to align the centroid within B/P tolerance. The rework was acceptable.
A188499 3-1-66	Inspection of the cylindrical tank revealed that the 0.040 in. x 45° chamfered surface of the ring angle was draw filed during weld preparation. DPS did not authorize this work.	Draw filing of the chamfer was acceptable to Engineering. The DPS was rewritten to reflect updated method of preparation.

TABLE II (Continued)

Section 4. LOX Tank Assembly, P/N 1A39307-507

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A169209 10-26-65	Inspection of baffle, P/N 1A39267-401, at the forward end of cone and circumferential panels, 3 5/8 in. from forward edge, showed evidence of electric arc burns on inside anodized surfaces. Burns were 5/32 in. to 5/16 in. in length and irregularly spaced.	Burned condition was blended out with No. 400 sandpaper and touched up with anodine 1200 per DPS 41410 and MIL-C-5541. Rework acceptable to Engineering.
A177831 12-15-65	Visual inspection revealed indentations and depressions in the inside surface of the standing leg and the base leg of the common bulkhead ring between seams 3 and 4.	Defects were scraped, smoothed and blended in with surrounding surface. Rework acceptable to Engineering for use.
A182613 1-12-66	The flatness tolerance of 0.030 in. at the forward trim line of the aft dome was not held in relation to the check points on the A652-1A39309-1WF3 LOX welder, after centering the jamb per gap M1 of QEC 647A.	Defect acceptable to Engineering.
A182618 1-14-66	The 1/4 in. lockbolt holes in segments 7 and 8 were located 5/8 in. and 1 5/8 in., respectively, from the centerline of seam 7. The holes should have been located 1 1/8 in. from the seam centerline per B/P 1A39307.	Defect acceptable to Engineering for use.
A182621 1-14-66	There was a 1 in. lack of fusion in the aft face weld from seam 8 toward seam 7.	Defect was ground out and auto-rewelded. The rework was acceptable.
A182622 1-15-66	During the initial pass of the forward side of the common bulkhead to aft dome weld the welder stopped after one foot of travel.	Weld was chipped out 2 in. back of weld termination and rewelded. The rework was acceptable.

TABLE II, Section 4 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A182627 1-17-66	A mismatch existed between thrust structure attach angles at the heel line.	Mismatch acceptable to Engineering for use.
A182630 1-18-66	Inspection of the bulkhead installation revealed that several hi-lock holes were elongated.	Defective holes were reamed out, and 1/64 in. oversize hi-locks were installed. The rework was acceptable.
A182639 1-20-66	Gussets, P/N's 1B31289-43 and -44, and strut, P/N 1B32892-1, used for the attachment of strut tube, P/N 1B32892-401, were mislocated 3 in. on the baffle assembly, P/N 1A39267.	The mislocated parts were relocated, and all extraneous holes were plugged. Rework acceptable to Engineering for use.
A182647 1-22-66	Helium leak test revealed that several lockbolts leaked in excess of 1×10^{-6} scim.	The defective lockbolts were removed. The holes were reamed out and lockbolts 1/64 in. oversize were installed.
A188496 2-24-66	During stud removal per B/P 1B59281, studs broke 0.015 in. below parent metal surface.	Defective areas were blended out to a 10:1 ratio. Rework was acceptable to Engineering for use.
A188669 2-24-66	X-ray 66-50 and dye check of the LOX tank meridian welds revealed a void and larger than No. 3 porosity in the inside weld, between seam 9 and seam 1.	The porosity was ground down to No. 1 porosity. The remaining porosity and void acceptable to Engineering for use.

TABLE II, (Continued)

Section 5. Common Bulkhead Assembly, 1A39309-501

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A126961 3-6-65	X-ray 65-B30, ACS, of the aft ring assembly showed a crack in the standing leg of seam 1, view A.	The crack was ground out, rewelded, and determined by X-ray to be acceptable for use.
A126968 3-15-65	X-ray 65-B41 of the aft ring weld showed at seam: 1, view A - void, connected porosity, and an inclusion. 2, view A - voids. 3, views A and B - void and scattered porosity and void, respectively.	Seams 2 and 3, views A and B, respectively, were acceptable to Engineering. Seams 1 and 3, views A and A, respectively, and seams 1 and 3, views A and A, respectively, were ground out, re-X-rayed and resubmitted to Engineering. Seams 1 and 3, views A and A, respectively were reWelded, re-X-rayed, and resubmitted to Engineering. Rework acceptable to Engineering.
A136902 3-21-65	X-ray 65-B41, ACS, of the forward ring assembly showed: a. A crack extending from the forward edge of the standing leg to 3/8 in. aft of the "Y" section radius, seam 1. b. A 1/2 in. crack in the standing leg of seam 3, 1/4 in. aft of the forward edge.	The defects were ground out and rewelded three times, and the areas were subsequently reworked per SEO 1A39309-007, which was acceptable to Engineering.
A136903 3-23-65	X-ray 65-B45 BM of the aft ring assembly showed lack of fusion in the aft leg of seam 2, view B.	The defect was ground out and rewelded twice, and the area was then accepted for use.
A136916 4-7-65	X-ray 65-B45 AM of the aft ring assembly showed:	a. The defect was ground out and rewelded, and found acceptable for use.

TABLE II, Section 5 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A136916 (Cont.)	a. Crack in view 1B, seam 1. b. Cracks and inclusion in view 1B, seam 2.	b. The crack remained after one reweld operation, consequently, the area had to be rewelded three times. The rework was acceptable.
A136918 4-8-65	X-ray 65-B41 ACS of the forward ring assembly showed cracks in seam 1A.	The cracks were ground out and rewelded, and were found to have been removed per X-ray 65-B41 ACS R1.
A136938 5-3-65	Dye check of the forward ring assembly showed cracks in seam 3, view B-B, in the inside diameter of the standing leg.	The indications were ground out and, after re-dye check, were accepted for use.
A136939 5-4-65	X-ray 65-B60 and dye checks of the aft face meridian welds indicated:	
	a. Seam 1 had cracks, voids, voids with tail, porosities, connected porosities, clusters of porosity, and inclusions (linear and transverse).	a. Seam 1 rewelded 3 times, contour became canned after several attempts to grind out and blend defects. Segment 1 remove and replaced. Required one reweld, was then acceptable to Engineering.
	b. Seam 2 had cracks, voids, voids with tails, porosities, connected porosities, clusters of porosity, cold lap, inclusions, and linear inclusions.	b. Seam 2 rewelded ten times, contour became canned and defects still existed. Removed and replaced segment 2, it then required one reweld before being acceptable to Engineering.
	c. Seam 3 had void, void with tails, porosities, connected porosities, clusters of porosity, inclusion, and linear inclusions.	

TABLE II, Section 5 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A136939 (Cont.)	d. Seam 4 had voids with tail, connected porosities, and inclusions.	c. Seam 3 rewelded three times before accepted by Engineering.
	e. Seam 5 had voids with a tail, cracks, transverse cracks, inclusions, dense foreign material, underfill, and clusters of porosity.	d. Seam 4 was rewelded one time and was then acceptable to Engineering.
	f. Seam 6 had void with a tail, connected porosities, inclusions, clusters of porosity, voids, underfills, and underfills with inclusions.	e. Seam 5 rewelded two times, contour became canned after several attempts to grind out defects. Segment was recontoured, defects were ground out and were then acceptable to Engineering.
	g. Seam 7 had inclusions, voids with a tail, connected porosities, clusters of porosities, and incomplete fusion along edge.	f. Seam 6 rewelded two times, contour became canned. Recontoured canned area, and ground out and blended existing defects, then acceptable to Engineering.
	h. Seam 8 had voids, voids with a tail, connected porosities, linear porosities, inclusions, linear inclusions, cracks, and clusters of porosity.	g. Seam 7 rewelded four times. Defects were ground out and blended to 10:1 ratio, then accepted by Engineering.
	i. Seam 9 had voids, voids with a tail, porosities, connected porosities, inclusions, cold laps, clusters of porosity, and transverse indication of inclusion.	h. Seam 8 rewelded three times. Contour became canned. Recontoured, but unable to remove defects. Removed and replaced segment 9. Required one reweld then acceptable to Engineering.
	j. All seams showed evidence of grindout and scratches from scraper.	

TABLE II, Section 5 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A136939 (Cont.)		i. Seam 9 rewelded five times. Contour became canned. Recontoured but defects remained. Removed and replaced segment 1. Ground out defects of replacement weld; then acceptable to Engineering. j. Smoothed and blended all grind out and scraper marks. Smoothing and blending acceptable to Engineering.
A136977 6-14-65	X-ray 65-B72 and dye check of the forward face showed: a. Dye check indications were intermittent throughout entire length of all meridian welds (inside and outside). b. X-ray indicated intermittent inclusions, linear indications, cold laps, underfill, connected porosity, voids, voids with a tail, scratches in parent material, and mechanic damage at edge of welds.	a and b. Seams 2, 4, 7, 8, and 9 required two rewelds and grindouts before acceptance by Engineering. Seams 5 and 6 required three rewelds before acceptance by Engineering. Seam 3 required one reweld before acceptance by Engineering. Seam 1 required four rewelds before acceptance by Engineering.
A136993 6-27-65	X-ray and dye check of the aft ring to aft face weld revealed: a. Connected porosity and oversize grindouts between seams 1 and 2. b. Oversize grindouts between seams 2 and 3, and 3 and 4, several locations.	All defects were ground to a 10:1 ratio, etched, dye checked, and polished. Dye check revealed several No. 2 and 3 porosities which were ground out acceptably.

TABLE II, Section 5 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A136993 (Cont.)	c. Linear porosity and excessive grindouts between seams 4 and 5. d. Excess grindouts between seams 5 and 6, and 6 and 7. e. Excess grindouts and connected porosity between seams 7 and 8, and 8 and 9.	
A136999 7-8-65	The following defects were noted in the forward face to ring weld: a. Seam 1 to seam 2 - No. 1 porosity at 61 1/4 in., No. 2 porosity at 16 in. b. Seam 3 to seam 4 - No. 2 and 3 porosities, several locations. c. Seam 5 to seam 6 - check conditions, void with a tail, and No. 2, No. 3, and scattered porosities. d. Seam 6 to seam 7 - check condition, several locations. e. Seam 7 to seam 8 - linear porosity. f. Seam 8 to seam 9 - check condition, linear, No. 1, and No. 2 porosity and cracks. g. Seam 9 to seam 1 - No. 1 porosity and mechanical damage to segment adjacent to weld.	All No. 2 and 3 porosities were ground out, as were cracks and check conditions. The void was acceptable, and the mechanical damage was blended out. Defects between seams 6 and 7 were re-welded, as were remaining defects between seams 1 and 2, and 8 and 9. The rework was acceptable.

TABLE II, Section 5 (Continued

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A142932 6-16-65	Aft face segments, P/N 1A39288-501, S/N's 00154, 00155, and 00158 were removed from the aft face assembly per FARR A136939.	The three segments were scrapped.
A142939 6-25-65	There was a 1/4 in. sharp depression in segment 3 of the forward face, 14 in. from the aft net trim and 16 in. from seam 3.	The depression showed no indication when dye checked. The area was then smoothed out and touched up with alodine on the outside. The rework was acceptable.
A142947 7-4-65	There were can conditions in the forward common face as follows: a. Seam 5, 34 1/2 in. to 42 1/2 in. and 45 in. to 52 in. from the forward end of the face. b. Seam 1, 62 in. to 68 in. from the forward end. c. Seam 4, 23 in. to 31 in. from the forward end.	The areas were reformed per B/P using electromagnetic forming per DPS 12070. Dye check of adjacent weld revealed No. 3 porosity in seam 4, which was ground out, blended, and accepted.
A142948 7-6-65	37 1/2 in. from ring seam 3 toward ring seam 1, there was a V-shaped notch, 1/4 in wide x 1/8 in. deep, across the inboard side of the left lug.	The ear of the lug was chamfered. Dye check showed the defect to have been removed.
A142949 7-6-65	More than ninety-six hours elapsed between the end of cleaning ring, P/N 1A39280-11 and the start of welding.	Critical surfaces were wire brushed ninety-one hours after cleaning, therefore, the condition was accepted for use.

TABLE II, Section 5 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A146950 9-26-65	Visual inspection of the forward face meridians showed: a. Numerous small spots of discoloration on inside welds. b. Numerous scratches on inside and outside area of segments near welds.	a. Discoloration acceptable to Engineering. b. Numerous scratches were blended out without increasing depth, then anodized before acceptance by Engineering.
A155224 7-22-65	There was an underfill area in the forward face to center plate inner weld bead, 7/8 in. from seam 1 toward seam 9.	The area was smoothed, blended, and accepted after dye check.
A155315 7-29-65	Near weld seam 9, between stations 34.5 and 34, the honeycomb core was sanded to 1.610 in. in a 12 sq. in. area. Minimum thickness should have been 1.750 in.	Acceptable to Engineering for use.
A155316 7-30-65	Numerous discoloration spots appeared on the forward face after application of primer, P/N HT-424.	The areas were stripped with primer thinner, cleaned with deionized water, and dried thoroughly. Slight stains remaining were acceptable for use.
A155320 8-5-65	Thermocouple temperature differentials exceeded maximum allowable five times during first cure cycle.	Acceptable to Engineering for use.
A155321 8-9-65	Numerous areas of discoloration were noted throughout the concave side of the bulkhead.	The areas were washed down, removing all residue. Paint stripper was used to remove discoloration. The rework was acceptable.

TABLE II, Section 5 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A158416 7-31-65	X-ray 65-B87BM of aft ring seam 2 revealed a crack in view A, and lack of fusion in view B.	The defects were ground out, rewelded, re-X-rayed, and found acceptable.
A158675 8-19-65	There were numerous underfill areas throughout the seal weld.	The areas were ground, and a third weld pass was made around the entire circumference. The rework was acceptable.
A161953 8-24-65	There were leaks in the seal weld between seams 1 and 2, and seams 3 and 1, in six locations.	The areas were ground out and rewelded. Subsequent leak checks revealed that all leaks had been removed.
A161959 8-25-65	There was a ding, 1/4 in. x 3/4 in. x 0.018 in., in the aft face of the bulkhead, 13 3/4 in. from seam 3 and 68 in. forward of the ring weld.	The area was etched, dye checked, and growler checked. No indications were present, and the ding was accepted for use.
A161965 8-28-65	There were out-of-contour conditions at 82° latitude and 0° to 40° longitude, two places. The +0.011 -0.239 in. tolerance was exceeded to -0.248 in., per QEC 657B.	Acceptable to Engineering for use.
A164826 9-21-65	X-ray 65B110 and dye check of the aft face showed: a. Dye check indications varied on meridian welds from 0.005 in. to 0.068 in., with No. 2 and 3 porosity. b. X-ray indicated void, void with a tail, connected porosity, and linear indication in varing degrees on the meridian welds.	a. Seams 1, 2, 3, 4, 8, and 9 required grind out and blending to 10:1 ratio to remove defects before acceptance by Engineering. b. Seams 5, 6, and 7 required one reweld with grind out and blend to a 10:1 ratio to remove defects before acceptance by Engineering.

TABLE II, Section 5 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A164828 9-24-65	X-ray 65-B113 and dye check of the forward ring showed: a. Crack in seam 1, view a. b. Crack in standing leg.	a and b. The areas were rewelded two times, ground out, re-X-rayed, resubmitted, and acceptable to Engineering.
A164829 9-23-65	Dye check of the forward face indicated No. 2 porosity in all meridian welds with grindout conditions.	Grindout conditions were blended to 10:1 ratio. Blended grindout and No. 2 porosity were acceptable to Engineering.
A164843 9-29-65	Dye check showed, after bond, No. 3 porosity on inboard face of aft ring seam 1.	The area was ground out three times, and blended to 10:1 ratio. The rework was acceptable following re-dye check.
A164844 9-29-65	Dye check of the forward ring showed cracks on forward edge of base leg and standing leg, at seam 3.	Cracks were ground out, rewelded, X-rayed, and resubmitted before acceptance by Engineering.
A166895 10-10-65	a. The forward common face had splattered spots and runs of DPM 1571 (pasa-jell) on exterior surface. b. Surface scratches existed on forward anodic surface of assembly (maximum depth 0.001 in.)	The affected surfaces were touched up with alodine. The rework was acceptable.

TABLE II, Section 5 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A166904 9-28-65	Forward face seams 1, 2, 3, and 4 did not comply with DPS 10.320-4. No record of welding parameters (volts, amperes, travel speed and wire feed), was kept. Seam 4 recorded volts only.	Meridian seams were accepted by Engineering on FARR A164829.
A166906 9-28-65	Visual inspection showed a scratch, 24 in. long by 0.002 in. deep in inner surface of segment 5, aft face.	The scratch was touched up with alodine. The rework was acceptable.
A169389 10-15-65	Welding of the aft ring stopped at a point 25 in. from seam 8 toward seam 9.	Weld was chipped out 2 in. back from point of termination. Then weld was continued to end of seam. The rework was acceptable.
A169433 11-14-65	Inspection of the aft face revealed that a 3 1/2 in. by 3 in. area of segment 5 honeycomb was below B/P tolerance. Thickness of honeycomb was 0.135 in. Should be 0.144 in. minimum.	Defect did not impair use of segment; therefore, segment was acceptable to Engineering for use.
A169434 11-5-65	a. Etch solution (DPM 961) leaked through masking material several places on forward face, removing anodic finish adjacent to meridian weld areas at seams 1 through 9. b. Etch solution (DPM 961) leaked through masking material onto inside periphery of the forward face ring, causing discoloration.	a. Areas were touched up with alodine per DPS 9.45, where anodic had been removed. b. Discoloration spots were sanded lightly to remove discoloration. Rework acceptable to Engineering for use.

TABLE II, Section 5 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A169435 11-5-65	An inspection made at the request of Production, revealed that the palino block pre-dimensional check was made at position 2. However, the final bond installation was position 1, resulting in excessive wrinkles in the dollar plate and in areas of segments 3, 4, 8, and 9.	The vacuum was retained and the temperature was increased to 110°F for one hour. The wrinkles were eliminated and part was accepted by Engineering for use.
A169436 11-10-65	a. During bonding operation of the bulkhead identification tag, a total loss of vacuum occurred at 327°F. A minimum vacuum of 10 in. Hg should be maintained during final bonding. b. A mismatched condition of 0.148 in. existed between forward and aft rings, halfway between seams 2 and 8 on the forward face. Maximum mismatch per B/P is 0.125 in.	a and b. The loss of vacuum and mismatch of rings did not impair the use of the bulkhead; therefore, the bulkhead was acceptable to Engineer- for use.
A171508 10-18-65	X-ray 65-B110 and dye check of the aft face meridians showed seam 3 to seam 4 had a void with a tail and No. 3 porosity; seam 6 to seam 7 was undercut in inside weld; seam 8 to seam 9 was checked and cracked on outside weld, and undercut on inside weld.	Seam 8 to seam 9 required one reweld. All seams were ground out to 10:1 ratio and blended. Rework acceptable to Engineering for use.
A171510 10-21-65	X-ray 65-B93 showed a void with a tail seam 4 to seam 5, and a cluster of porosity seam 5 to seam 6.	Seam 5 to seam 6 required one reweld. Defects in seam 4 to seam 5 were ground out and blended to a 10:1 ratio. Rework acceptable to Engineering for use.

TABLE II, Section 5 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A171516 10-23-65	X-ray 65-B110 of the forward face center plate showed connected porosity at various locations throughout entire seam.	Defects were ground out and rewelded before acceptance by Engineering for use.
A171567 11-17-65	There was No. 3 porosity in the ring to dome weld between seams 7 and 8.	Defect was removed by grindout, smoothing, and blending to a 10:1 ratio. Rework acceptable to Engineering for use.
A172004 10-22-65	The environmental requirements, stated in DPS 14052, were not met during the reweld of the aft ring required per FARR A171510. The temperature was 88°F as opposed to 80°F permissible.	Engineering accepted the temperature differential as a permissible environmental welding range.
A172005 10-22-65	Inspection of the center plate weld revealed an indentation, 1/32 in. wide by 0.003 in. in depth, parallel to the center line of the center plate inside weld and 3/16 in. away from the center line. Indentation extended 60 per cent of segment circumference on the side of the weld on the segment face.	The indentation did not impair the segments. Acceptable to Engineering for use.
A172014 10-25-65	Inspection of the aft face revealed an 8 in. x 5 in. x 0.250 in. canned condition in segment 8 and extending across the center plate weld bead into the center plate.	Canned condition acceptable to Engineering for use.
A172016 10-25-65	Inspection of the aft face revealed out-of-contour conditions at latitudes 82° and 90°, and longitudes 10° through 40°, and 160° through 360°, respectively. Out-of-contour dimensions at 82° and 90° latitudes were -0.517 in. (should have been -0.122 to -0.322 in.) and -0.650 in. (should have been +0.002 to -0.498 in.).	Although out-of-contour conditions existed, they did not impair the use of part; it therefore was acceptable to Engineering for use.

TABLE II, Section 5 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A172136 11-12-65	The seal weld did not comply with B/P 1A39309, Zone 12, view D. The B/P called for two 5/32 in. fillet welds. Three welds were made with the third weld in the center of the -9 spacer.	The seal weld was X-rayed, dye checked, leak checked, and visually inspected. The three-pass weld was acceptable to Engineering for use.
A172139 11-13-65	Contour out-of-tolerance condition existed at latitudes 82° and 90°. Contour condition at 82° varied between -0.302 and -0.397 in., but it should have been -0.047 to -0.297 in. Contour condition at 90° was -0.406 in., but it should have been -0.069 to -0.319 in.	Out-of-tolerance condition did not impair use of common bulkhead; therefore, Engineering accepted it for use.
A177815 12-8-65	Pasa-jell splatter was noted on aft face of common bulkhead on anodized surface.	Acceptable to Engineering for use.

TABLE II, (Continued)

Section 6. Aft Dome Assembly, P/N 1A39308-507

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A169379 10-19-65	Inspection of segment, S/N 00155, showed a 0.005 in. x 1/32 in. x 1 1/2 in. scratch on outside surface of segment, 12 in. from aft end rough trim and crosswise of weld pass at next assembly seam 3.	Scratch did not impair use of segment. Segment was acceptable to Engineering for use.
A169385 10-13-65	Etching material had splattered on outside surface of segment, S/N 00156, causing removal of the anodic material.	Areas where anodic had been removed were touched up per DAC spec F-289. The rework was acceptable.
A169390 10-16-65	Visual inspection of segment, S/N 00156, revealed: a. Backside shrinkage on inside of L-L fitting, approximately 75 per cent of circumference, directly opposite outside edge of weld. Maximum depth of depression was 0.026 in. Width was 1/16 in. to 1/8 in. b. Excess penetration bead on inside of fitting adjacent to depression. Maximum height was 0.030 in.	a and b. Excess penetration was ground flush +0.005 in., dye checked and blended. Defect did not impair use of segment; therefore, segment was acceptable to Engineering for use.
A169392 10-16-65	Inspection of segment, S/N 00162, revealed underfill and no fusion at two 1/2 in. areas of inside fillet weld of H-H flange.	Underfill and lack of fusion areas were ground out and rewelded. The rework was acceptable.

TABLE II, Section 6 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A169394 10-19-65	Inspection of segment, S/N 00185, revealed the AC-AC fitting outside weld had 3/32 in. x 3/16 in. x 0.020 in. depression in crown of tie-off area.	Defect did not impair use of segment; therefore, segment was acceptable to Engineering for use.
A171506 10-12-65	X-ray 65-B122, view 2, of segment, S/N 00152, showed a void with a tail, lack of fusion, and porosity in the outside weld.	Outside weld rewelded two times before acceptable to Engineering for use.
A171518 10-25-65	Dye check of segment, S/N 00158, showed crack in inside weld at view 5, GG fitting, and No. 1 porosity after grindout to remove crack.	Defect was ground out, smoothed, and blended to a 10:1 ratio. Smooth and blend acceptable to Engineering for use.
A171552 11-9-65	X-ray 65-B122 and dye check of aft dome meridians showed: a. Lack of fusion at the edge of penetration, segment 3 side of weld seam 3. b. Linear porosity transverse to weld seam 8.	a. Meridian seam 3 was ground out, smoothed, and blended until defect was removed before acceptance by Engineering for use. b. Meridian seam 8 was ground out, smoothed, and blended until defect removed before acceptance by Engineering for use.
A171580 11-24-65	X-ray 65-B122 of the aft dome meridians showed: a. At the junction of seams 1 and 2, a crack 9/16 in. in length extending across seam 1 from the jamb weld.	a, b, and c. Segments with defective welds were cut out and tests were made to determine cause of cracks. New segments were welded into the dome. The rework was acceptable.

TABLE II, Section 6 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A171580 (Cont.)	b. At the junction of seams 2 and 3, a crack 3/8 in. in length, transverse to jamb weld, extending across seam 2 from jamb weld. c. At the junction of seams 7 and 8, a crack 5/16 in. in length, transverse to jamb weld, extending across seam 7 from jamb weld.	
A171582 11-30-65	Dye check of fitting, S/N 00171, outside weld showed connected porosity between views 1 and 2.	Defects were ground out and blended. Grindout and blend acceptable to Engineering.
A171596 12-7-65	X-ray 65-B149 of segment 8 showed voids in weld at view AB-AB.	Voids were not serious enough to cause rework. Weld is acceptable to Engineering for use.
A171598 12-8-65	Dye check of segment 3 to B-B fitting inside weld showed a crater crack at view 4.	Defect was ground out and blended. Rework acceptable to Engineering for use.
A171978 10-29-65	Inspection of segment, S/N 00155, revealed numerous etch splatters on outer surface, which removed anodic finish.	Splatter marks were touched up with zinc chromate primer. Rework acceptable to Engineering for use.
A171986 11-2-65	The thickness of the segment at seam 7 weld pad area was below B/P requirement of 0.191 ± 0.005 in. Segment thickness in the noted area varied from 0.182 in. to 0.185 in.	Out-of-tolerance thickness of segment acceptable to Engineering.
A172008 10-22-65	Scratches were found in anodized surface of weld pad, and adjacent to the waffle pattern near the AB-AB fitting.	Scratched areas were touched up with alodine per DPS 9.45. The rework was acceptable.

TABLE II, Section 6 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A177835 12-16-65	Inspection of segment 6 revealed that the outside fillet weld of the H-H wire leadout port flange fitting was undersize. Weld should have been 3/16 in. by 3/16 in; however, it was 1/8 in. by 5/32 in.	Defect did not impair the effectiveness of the H-H wire leadout port flange fitting; therefore, it was acceptable to Engineering for use.
A177841 12-19-65	The thickness of segment 2 at both meridian seams was under the B/P tolerance.	Under tolerance condition of segment 2 acceptable to Engineering for use.
A177850 12-22-65	Inspection of the meridian welds revealed that: a. Seams 5, 6, and 8 had grindout conditions to depth of -0.026 in. b. Seam 7 was mismatched by 0.030 in. at the trim line.	a. Grindouts were smoothed and blended to a 10:1 ratio. Rework acceptable to Engineering for use. b. Mismatch acceptable to Engineering for use.
A177874 1-3-66	The ovality of the flange, P/N 1A39308-441, exceeded B/P tolerances.	Excessive ovality of flange acceptable to Engineering for use.
A177887 1-7-66	X-ray 66-B122 and dye check revealed lack of fusion at faying edge, dense inclusion, and cracks inside seam 3.	Inclusions acceptable to Engineering. Lack of fusion and cracks in weld were ground out and rewelded. Two rewelds were required before acceptance by Engineering for use.
A177889 1-7-66	X-ray 66-B122A and dye check revealed lack of fusion at S-S elbow to tube faying edge, and cracks inside seam 3.	Defects were ground out and blended. Rework was acceptable to Engineering for use.

TABLE II, Section 6 (Continued)

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A177892 1-7-66	X-ray 66-B122A revealed scattered porosity in the forward side weld of the W-W bracket.	The porosity in the weld was not serious enough to warrant rework; therefore, Engineering accepted the weld for use.
A177893 1-7-66	Dye check revealed cracks and No. 3 porosity inside seam 3 and cracks on the outside of weld seam 3.	Defects were ground out, and the grind-out was blended to a 10:1 ratio. Rework was acceptable to Engineering for use.
A182601 1-5-66	On the aft dome, one stud, located near seam 8 on segment 8, was broken off at 25 in. - lbs. torque.	Old weld material was removed with spot face. A new stud was installed in accordance with DPS 14170. The rework was acceptable.
A182612 1-11-66	Fitting contour check of the aft dome revealed out-of-tolerance conditions at: a. Latitudes 17 1/2°, 30°, 50°, and 60°. b. R-R LOX chill return fitting. c. B-B LOX fill line. d. AK-AK LOX pressure sensor fitting. e. G-G LH_2 feed line fitting.	a through e. Out-of-tolerance conditions acceptable to Engineering for use.

TABLE II, (Continued)

Section 7. Forward Skirt Assembly, P/N 1B29835-503

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A197922 5-12-66	On stringers 99, 101, and 103, 4.5 in. forward of the aft interface, there were bar marks.	All sharp defects were blended and polished. A doubler was fabricated and installed per Engineering instructions. The rework was acceptable.
A198154 5-18-66	At stringers 4, 10, 28, 34, 40, 44, 52, 58, 64, 70, 76, 82, 88, 94, 100, and 105, station 676.702, AD5 rivets through intercostal, P/N 1B29835-43, and the forward interface were gapped 0.002 in. to 0.005 in.	A shim was installed to fill the gaps. The rework was acceptable.

TABLE II, (Continued)

Section 8. Aft Skirt Assembly, P/N 1B29825-507

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A197914 5-6-66	Between stringers 98 and 101, station 220, there were two excess attachments through angle, P/N 1A79478-49, causing a short edge distance for one hole at each end.	One extra B/P attachment was installed evenly spaced between the second and third attachments. Otherwise, the condition was accepted by Engineering for use.
A198174 6-2-66	At stringers 80 and 81, station 200, eight holes for jo bolts, P/N NAS 1669-3KS, were double drilled through support, P/N 1B32637-3, angles, P/N's 1B29827-5 and 1B64562-505, and strap, P/N 1B64561-507.	The support, angles, and straps were removed and replaced by new parts which were fabricated and installed per Engineering instructions. The rework was acceptable.
A203409 6-24-66	At stringer 98, station 200, one 0.2465/0.2485 in. hole for a hilok bolt, P/N HL20-8, was elongated to 0.273 in. through angle, P/N 1A79478-49, and segment, P/N 1B58554-1.	The hole was enlarged to 0.308/0.310 in. for installation of hilok bolt, P/N HL20-10, and collar, P/N HL72-10. The rework was acceptable.

TABLE II, (Continued)

Section 9. Thrust Structure Assembly, P/N 1A39316-507

FARR NO.	DESCRIPTION OF DEFECTS	DISPOSITION
A197904 4-29-66	One 3/16 in. hole was drilled in the stayout area of stringer 18, the flange of frame, P/N 1A68381-1, and the skin.	The hole was plugged double flush with AD rivet material. A hole was drilled to install the B/P attachment. The rework was acceptable.
A197917 5-10-66	a. There were sixty-five 5/32 in. holes misdrilled at stringers 9 and 10. b. One BB5 rivet was installed by mistake in each of stringers 9 and 10.	a and b. After plugging several mislocated holes, both stringers were removed and replaced per B/P. The rework was acceptable.
A198152 5-17-66	On brackets, P/N's 1B38493-3, -5, and -9, the 1 3/4 in., 1 1/2 in., and 1 9/16 in. dimensions, respectively, were out of tolerance.	A shim was fabricated and installed per Engineering instructions to fill the gaps. The rework was acceptable.
A209897 4-26-66	On frame assembly, P/N 1A68381-1, the -15 strap was mislocated 3/4 in. counterclockwise, and the -23 frame rode the strap.	The strap was removed and replaced per B/P. The rework was acceptable.

GLOSSARY OF TERMS

ABCL	As Built Configuration List. A listing of the part number, change letter, and manufacturing position index number. Compiled by the Reliability Assurance Department from the manufacturing paper applicable to the stage.
ACS	Automatic Checkout System (Complete Complex)
AFQA	Air Force Quality Assurance
AGC	Automatic Gain Control
AO	Assembly Outline. Document controlling the assignment of work to assembly areas, and provides a record of conformance. Planned and released by Manufacturing Planning and verified through Reliability Assurance (Quality Control) procedures.
APS	Auxiliary Propulsion System
CCO	Contract Change Order
COAL	A computer routine for changing data in memory.
Countdown	Tasks carried on during the backward counting (in minutes and seconds) from initiation to conclusion of a propellant loading, or static firing exercise.
Critical Components	Those functional components essential to stage performance.
DDAS	Digital Data Acquisition System
Dye Check	Dye penetrant Inspection. Visual identification of surface weld defects, such as porosity and cracks, with a colored dye.
EBW	Exploding Bridge Wire System
ECL	Engineering Configuration List. A tabulated listing of the Douglas/vendor part numbers, Douglas/government/industry standard part numbers, specification and source control drawing numbers, processes and material specification numbers, test requirement drawing numbers, bulk material identification numbers, serialized engineering order and drawing change request engineering order numbers, plus the part number and drawing change letters defining the engineering released design intent applicable to this end item.

GLOSSARY OF TERMS (Continued)

ECP	Engineering Change Proposal
End Item	A customer-required system, or any principal system or subsystem elements. Also, those articles covered by major subcontracts, delivered direct to a customer, or provided as customer furnished property to a contractor.
EO	Engineering Order. Engineering document which is used to release design intent, for development and manufacture.
FM	Frequency Modulated radio transmission.
FARR	Failure and Rejection Report. A report used to identify or divert nonconforming material. Also used to record dispositions of such material, and the corrective action taken to prevent recurrence.
FACI	First Article Configuration Inspection
Form DD250	A material inspection and receiving report used to transfer an end item from one location or responsible agency to another.
Form DD829-1	Historical record used to document scope change verification.
FTC	Florida Test Center. Douglas Missile and Space Systems Division test center at Cape Kennedy, Florida.
Growler Inspection	A sonic inspection method for detecting internal discontinuities in Saturn stage common bulkheads.
GSE	Ground Support Equipment. Equipment whose function is to transport, protect, handle, service, test, check out, and monitor the complete Saturn S-IVB stage, separate assemblies, or components.
H&CO	Handling and checkout drawings (test procedure)
He	Helium
IIS	Inspection Item Sheet
IU	Instrument Unit
KSC	Kennedy Space Center, located in Florida.
LH_2	Liquid Hydrogen
LOX	Liquid Oxygen

GLOSSARY OF TERMS (Continued)

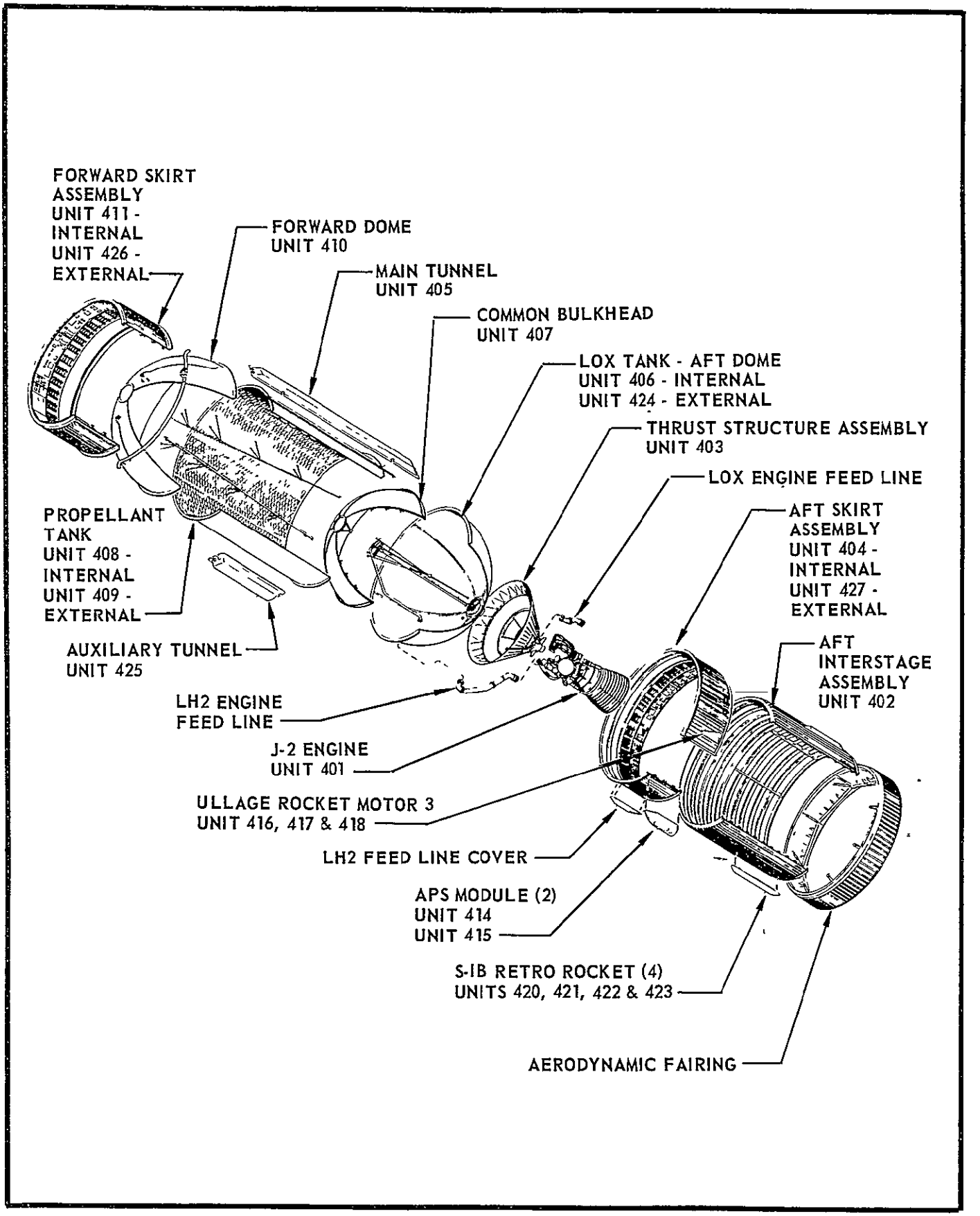
Log Book	A compilation of special records, packaged in book form, pertaining to a given end item.
MRB	Material Review Board. A committee which evaluates and determines the disposition of all rejected material (other than obvious scrap or incompletes) and initiates corrective action to prevent recurrence of the nonconformances leading to the rejections.
NPC 200-2	NASA Quality Publication. The Quality Program Provisions for Space Systems Contractors.
OLSTOL	On Line Saturn Test Oriented Language. A method of manual (i.e. typewriter) input to correct a computer program.
PAM	Pulse Amplitude Modulated radio transmission
PCM	Pulse Code Modulated radio transmission
PCL	Planning Configuration List. Tabulated listing prepared by the planning release group containing that information listed on the engineering configuration list plus information required by the planning and manufacturing departments.
Permanent Nonconformance	A condition, signifying material is nonconforming at the time of inspection, and cannot be made to conform exactly.
Permeability	Degree to which one substance will diffuse through or penetrate another.
Porosity	Gas pockets or voids free of solid material occuring in welds.
PDM	Pulse Duration Modulation of radio transmission.
P/N	Part number
PMR	Programmed Mixture Ratio
ppm	Parts per million
PU	Propellant Utilization system
PUEA	Propellant Utilization Electronic Assembly
psia	Pounds per square inch, absolute. Pressure measurement which includes atmospheric pressure.
psig	Pounds per square inch, gauge. Pressure measurement which does not include atmospheric pressure.

GLOSSARY OF TERMS (Continued)

QEC	Quality Engineering Chart. A chart, prepared by Quality Engineering, which provides specific inspection instructions to shop personnel, and a means of recording sequential inspection for each unit fabricated.
RACS	Remote Automatic Calibration System (telemetry checkout).
RF	Radio Frequency
RMR	Reference Mixture Ratio
RPM	Revolutions per minute
RS	Range Safety
RSRS	Range Safety receiver system
SC	Scope Change. Changes, requirements, or details on all or any part of a program.
sccm	Rate of flow measurement - standard cubic centimeters per minute.
scim	Rate of flow measurement - standard cubic inches per minute.
SCO	Subcarrier Oscillator
SEO	Serial Engineering Order. Engineering order, generally used to authorize and describe rework in conjunction with a production change. The SEO is also used to issue information or work authorization when no drawing change is involved, i.e., salvages for manufacturing errors, and authorization for variation from engineering drawing requirements or information.
SIM	Safety Item Monitor
SPCR	Saturn Program Change Request
SSC	Space Systems Center. Douglas Missile and Space System Division Center at Huntington Beach, California.
STC	Sacramento Test Center, located at Sacramento, California
S/N	Serial number
TACD	Test Area Control Document

GLOSSARY OF TERMS (Continued)

TCC	Test Control Center
TCS	Thermoconditioning System
TD	Technical Directive
Time/Cycle Significant Item	A component or end item, the measured life of which is important enough to justify running time, cycle, or attribute data collection.
T/M	Telemetry
TR	Test Request
UHF	Ultra High Frequency
Ullage Pressure	The pressure of the gases in the unfilled portion of the propellant tanks.
Ultrasonic Inspection	An inspection method employing ultrasonic waves to detect discontinuities in internal insulation bonding.
Umbilical	Stage/GSE interface point for stage servicing and monitoring from a ground source.
VCL	Vehicle Checkout Laboratory, located at SSC and STC
VCO	Voltage Controlled Oscillator
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio. A measure of antenna efficiency.
WRO	Work Release Order. Document providing authority for the accomplishment of work within the Douglas Missile and Space Systems Division.



Exploded View of Stage

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